The MINING CONGRESS JOURNAL

Volume 11 OCTOBER, 1925 *No.* 10

IN THIS ISSUE

Western Mining Men Plan Convention

Generation and Utilization of Power in Copper Mining

Underground Mine Caving Methods

Automatic Control of Direct Current Circuits in Coal Mines

Increasing Lump Coal Production in Southern Illinois

Safety Practice in Underground Transportation

Metal Mine Accidents—Lake Superior Districts

Welfare and Safety in Utah Mining

Principles of Mine Safety Work

Will the Strike Stop Coal Deflation?

The Nation's Viewpoint

News of the Mining Field

Practical Operating Men's Department

Contributors

H. H. Pratt, J. P. Hodgson, T. F. McCarthy, J. E. Tiffany, J. J. McKitterick, Lucien Eaton, William Conibear, Dr. A. L. Murray, F. P. Botsford.

He gave the car another push —and surrendered

THE boss is no weakling but he had a hard job budging the first car.

"Try that other one" the superintendent suggested. Bracing himself for another struggle, the other gave a mighty shove and nearly lost his balance as the car rolled down the track.

"What's the answer?" he demanded.

"Hyatt roller bearings in that car. The difference between the roll and the drag of those two cars means a day-by-day gain of 25% in the amount of ore we tram. Add the fact that plain bearing cars have to be greased four or five times a week as compared to three or four times a year for Hyattized cars—there's a real saving. We ought to have Hyatt bearings in every car."

"Sounds good" the chief admitted. "But you know we can't invest new capital at the present time."

"Not necessary; we have to replace some of these old cars now—let's get Hyatt equipped cars in their place and start bringing this mine up to date."

The boss thought a minute, gave the Hyatt equipped another push—and surrendered.

Thus another mine took the step toward larger dollar and cents returns. Hyatt roller bearings are earning their way in hundreds of mines now. They can do the same for you. Most leading ore car manufacturers furnish them or, if you wish, we will design your running gear for you, without obligation.

HYATT ROLLER BEARING COMPANY

NEWARK DETROIT CHICAGO SAN FRANCISCO
WORCESTER PHILADELPHIA PITTSBURGH
CLEVELAND CHARLOTTE

XU

PRESENTING AN IMPROVED EXPLOSIVE

Chemists in the Hercules laboratories are always trying to improve explosives. Not simply to produce something new and different, but something more useful and efficient. Occasionally this constant effort is rewarded and a valuable addition is made to the list of commercial explosives.

Hercules Special No. 1 and Special No. 2 were really important contributions of recent years to the blasting industries. Where these explosives are suitable, a 15 per cent. reduction of blasting costs by their use is not uncommon. They are most widely adapted to quarry and open pit work.

The economy of Special No. 1 and Special No. 2 naturally appealed to underground miners, also. They are used successfully in some underground mines, but their fumes make them unsuitable for others.

The newly developed Hercules Special No. 3 has all the advantages of Special No. 1 and No. 2 with better fumes, and makes possible the reduction of costs underground to the same extent that Specials No. 1 and No. 2 lower costs in the open.

Hercules Special No. 3 represents another step ahead in commercial explosives. It meets a long-existing need. It is not a cure-all, but where it is adapted to the work, it will save money. Full particulars about this new explosive will be gladly furnished.

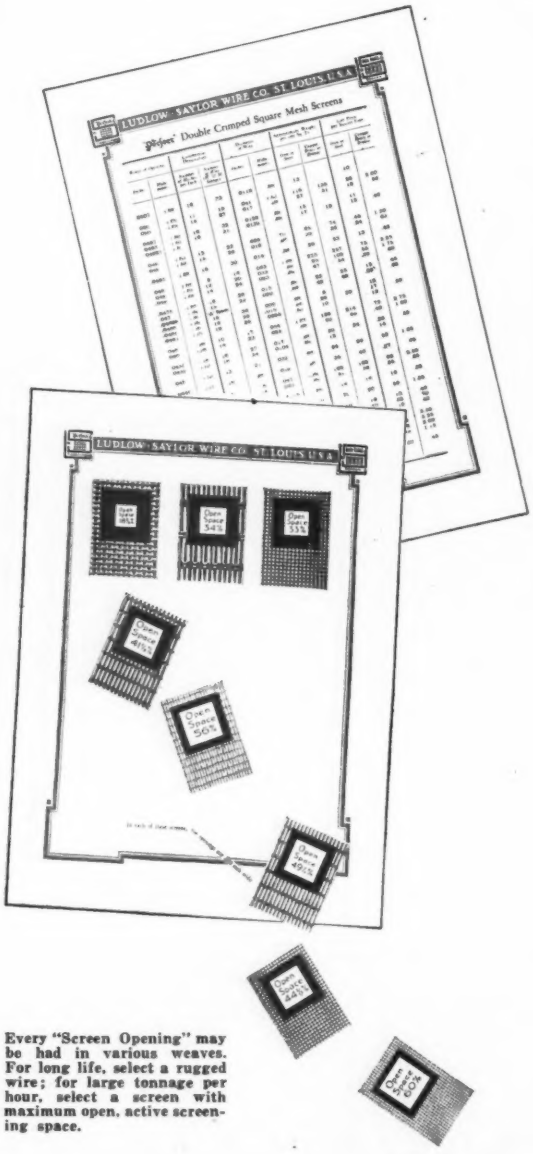
HERCULES POWDER CO.

BRANCH OFFICES

ALLENTOWN, PA.
BIRMINGHAM
BUFFALO
CHATTANOOGA
CHICAGO
DENVER
DULUTH
HAZLETON, PA.
HUNTINGTON, W. VA.
JOPLIN, MO.
LOS ANGELES
LOUISVILLE
NEW YORK CITY
NORRISTOWN, PA.
PITTSBURG, KAN.
PITTSBURGH
POTTSVILLE, PA.
ST. LOUIS
SALT LAKE CITY
SAN FRANCISCO
WILKES-BARRE
WILMINGTON

The Direct Cost of Wire Cloth for Process Equipments is a Very Minor Item in the Total of Operating Expense

BUT — Choose the RIGHT SCREEN, and the same equipment will turn out cleaner, more uniform work, require less attendance and power, and handle more tons per machine, per square foot, per screen-cloth, per man, per hour and per dollar.



Every "Screen Opening" may be had in various weaves. For long life, select a rugged wire; for large tonnage per hour, select a screen with maximum open, active screening space.

Note the accompanying illustration. It shows in miniature eight wire screens, all having openings identical in size. With any of them the product would be the same.

The heaviest contains ten times as much metal as the lightest; it costs five times as much. Its resistance to abrasion, pressure, shock, are many times those of the lighter screens. It is built for RESISTANCE—and it does resist—the tough, thick wires will wear, and wear, and wear.

But see the lightest screen—its active, open screening space is more than three times that which the heaviest screen affords. You can feed it faster. You can speed up the movement of oversize by increasing the angle of flow; and still you'll take out more fines, quicker, than with the heavy, more resistant screen.

Ludlow-Saylor Screens are made in countless weaves and kinds—hard or soft, tempered or annealed, rigid or flexible, pure metal or complex alloy.

Thoughtful selection of a Screening Surface considers ALL the factors bearing on the choice. In running time, shut-down time, in equipment investment, in floor space, in all the factors making up your overhead, GETTING THE RIGHT SCREEN WILL MAKE A DIFFERENCE.

MEMO

THE LUDLOW-SAYLOR WIRE CO.
608 So. Newstead Ave.
St. Louis

Send us your New General Catalogue No. 47-D.
We use

Grinding Equipment	Filter Equipment
Screening Equipment	Tumbling Equipment
.....	.....

Send samples as follows: .....

Firm .....

By .....

Street .....

City .....

The LUDLOW-SAYLOR WIRE COMPANY St. Louis

608 South Newstead Avenue

THE MINING CONGRESS JOURNAL

OCTOBER, 1925 CONTENTS $3.00 Per Year 30c Per Copy

Editorials Page

A New Tax Program ... 463
The Elephant Falters ... 463
Figuring the Truth ... 464
The Inevitable Denouement ... 465
Different Brands of the Same Article ... 466
The Answer ... 466

Feature Articles

Will the Strike Stop Coal Deflation—By George H. Cushing ... 467
Safety Practice in Underground Transportation—By Lucien Eaton ... 470
Principles of Mine Safety Work—By F. P. Botsford ... 473
Metal Mine Accidents—Lake Superior Districts—By William Conibear ... 474
Welfare and Safety in Connection with Mining in Utah—By Dr. A. L. Murray 478
The Purpose of the Practical Operating Department—By Guy N. Bjorge ... 480
The Generating and Utilization of Power in Copper Mining—By H. H. Pratt ... 481
Underground Mine Caving Methods—By J. P. Hodgson 483
Automatic Control of Direct Current Circuits in Coal Mines—By T. F. McCarthy 484
Method of Increasing Lump-Coal Production, with Especial Reference to Southern Illinois—By J. E. Tiffany and J. J. McKitterick ... 486

News

Western Mining Men Plan Convention ... 468
To Educate Workers ... 473
International First Aid and Mine Rescue Contest ... 477
State Organizations to Cooperate ... 482
The Nation's Viewpoint ... 489

PRACTICAL OPERATING MEN'S DEPARTMENT

METAL

The Purpose of the Practical Operating Department—By Guy N. Bjorge

The Generating and Utilization of Power in Copper Mining—By H. H. Pratt

Underground Mine Caving Methods—By J. P. Hodgson

COAL

Automatic Control of Direct Current Circuits in Coal Mines—By T. F. McCarthy

Method of Increasing Lump-Coal Production, with Especial Reference to Southern Illinois—By J. E. Tiffany and J. J. McKitterick

News—Continued Page

Salt Lake Meeting of Institute ... 495
Mineral Production in Montana in 1924 ... 495
Crude Petroleum Production in 1924 ... 496
Oil Shale Bibliography ... 496
National Directory of Commodity Specifications ... 496
Motor Gas Specifications ... 497
Asbestos in 1924 ... 498
Coal Mine Accidents for First Seven Months 1925 ... 499
Interior Creates Complaint Division ... 499
Mineral Lease Receipts Decline ... 499
Columbia River Basin Project ... 499
News of the Mining Field ... 500
With the Manufacturers ... 504

Illustrations

New Hampshire Avenue, at Dupont Circle, Washington, D. C. ... Insert
San Marcos Hotel ... 468
Street Scene in Phoenix ... 468
Street Scene in Phoenix ... 469
Roosevelt Dam ... 469
Two Avoidable Dangers Illustrated ... 470
Examples of Proper Precautions ... 471
Dangerous Practices ... 472
Holmes Mines, Cleveland-Cliffs Iron Company, Ishpeming, Mich. ... 474
Lake Angeline Basin, Ishpeming, Mich. ... 476
International First Aid and Mine Rescue Contest ... 477
A Diesel Engine Plant of the Phelps-Dodge Corporation ... 481
J. P. Hodgson ... 483
Automatic Switching Equipment, Jeddo Highland Coal Company ... 485
Charts of Methods Used in Blasting ... 487, 488

Published Every Month by the American Mining Congress, Washington, D. C.

JAMES F. CALLBREATH
Editor-in-Chief

E. R. COOMBES
Editor

MCKINLEY W. KRIEGH
Assistant Editor

GUY N. BJORGE
Associate Editor

ERNEST H. PULLMAN
Legislative Editor

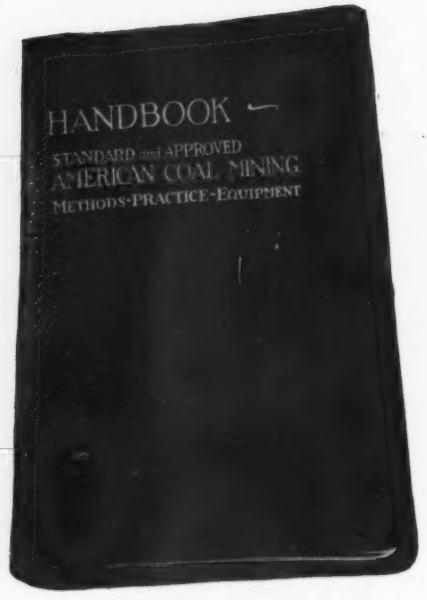
F. E. PRIOR
Art Editor

E. C. PORTER
Advertising and Business Manager

L. R. HUDSON
Field Representative

Entered as Second Class Mail Matter January 30, 1915, at the Post Office at Washington, D. C.

A Nation-Wide Movement
Between Its Covers



The book is pocket size, loose-leaf, and will be kept up to date as recommendations are approved. Its price is $5.00. This includes a subscription to THE MINING CONGRESS JOURNAL, which carries each month a department of practical operating problems.

A little book with a big purpose. This Handbook correlates for you, in working forms, applicable to your mine, the findings of the coal mining branch of the standardization movement. A book that makes coal mining more profitable; that is cooperatively backed by leading engineers and manufacturers of the country. Its treatment of the subjects listed below is a succession of hits at the high cost of mining. The book is made in loose-leaf form so that it can be kept up to date with supplementary reports. The world-wide demand for it indicates the growing strength of this movement.

IMPORTANT SUBJECTS TREATED

in the Handbook of Standard and Approved American Coal Mining Practice include: basic rules safeguarding electricity in mines; electric tipple equipment; underground stations (in fact all phases of automatic control of mine equipment); trolley and storage battery types locomotives; mine tracks, signals, and switches, including track gauge, turnouts, frogs and switches; mine cars; mine fans; airways and shafts and booster fans; wire rope, ladders, and miscellaneous coal handling equipment; pumps for development work, permanent pumping stations, natural drainage, and effect of mine water on equipment; loading machines, belt chain and shaking conveyors, installing and operating cutting and loading equipment; general mine timbering, preservation of timbers, and use of concrete and steel.

Standardization Division

The AMERICAN MINING CONGRESS

841 MUNSEY BUILDING, WASHINGTON, D. C.

STANDARDIZATION DIVISION, The American Mining Congress,
841 Munsey Building, Washington, D. C.

I am enclosing.....for.....copies of the Handbook of Standard and Approved American Coal Mining Methods, Practice Equipment—each order to include a subscription to The Mining Congress Journal.

Name .....Street .....

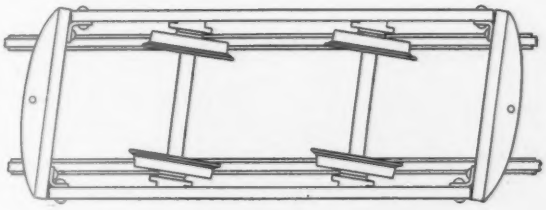
City ..... State .....

A Locomotive Frame Must Be Rigid

It's the Housing for all the Working Parts and the Basis of Good Performance

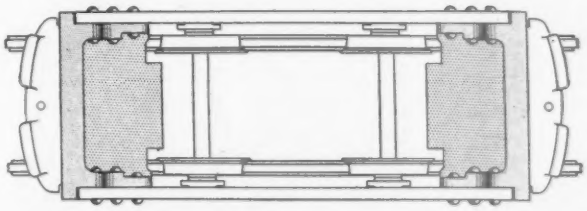
A "Bottomless Box" is Easily Put Out of Square

Corner Bracing Gives Stiffness to the Box

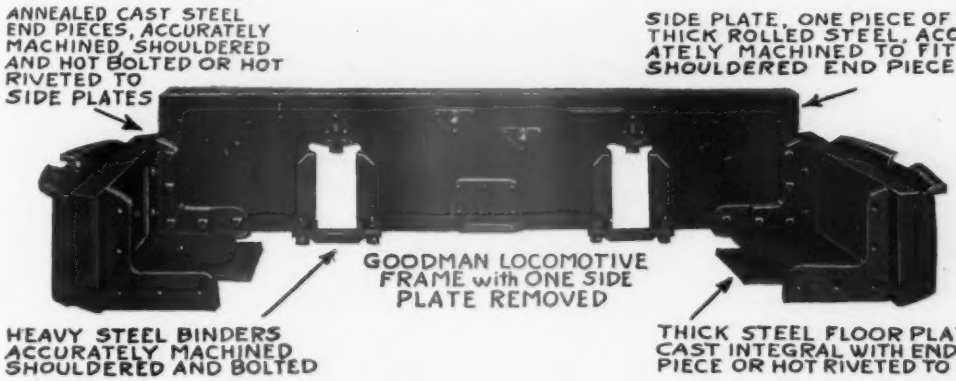


A Cornerwise Jolt May Throw a Weak Frame Out of Square

A locomotive even slightly deformed in this way cannot give good track performance, not to mention the internal difficulties due to misalignment of working parts.



Goodman Locomotive Frames are made rigid by their corner construction.


ANNEALED CAST STEEL END PIECES, ACCURATELY MACHINED, SHOULDERED AND HOT BOLTED OR HOT RIVETED TO SIDE PLATES
SIDE PLATE, ONE PIECE OF THICK ROLLED STEEL, ACCURATELY MACHINED TO FIT SHOULDERED END PIECES
GOODMAN LOCOMOTIVE FRAME with ONE SIDE PLATE REMOVED
HEAVY STEEL BINDERS ACCURATELY MACHINED SHOULDERED AND BOLTED
THICK STEEL FLOOR PLATE CAST INTEGRAL WITH END PIECE OR HOT RIVETED TO IT

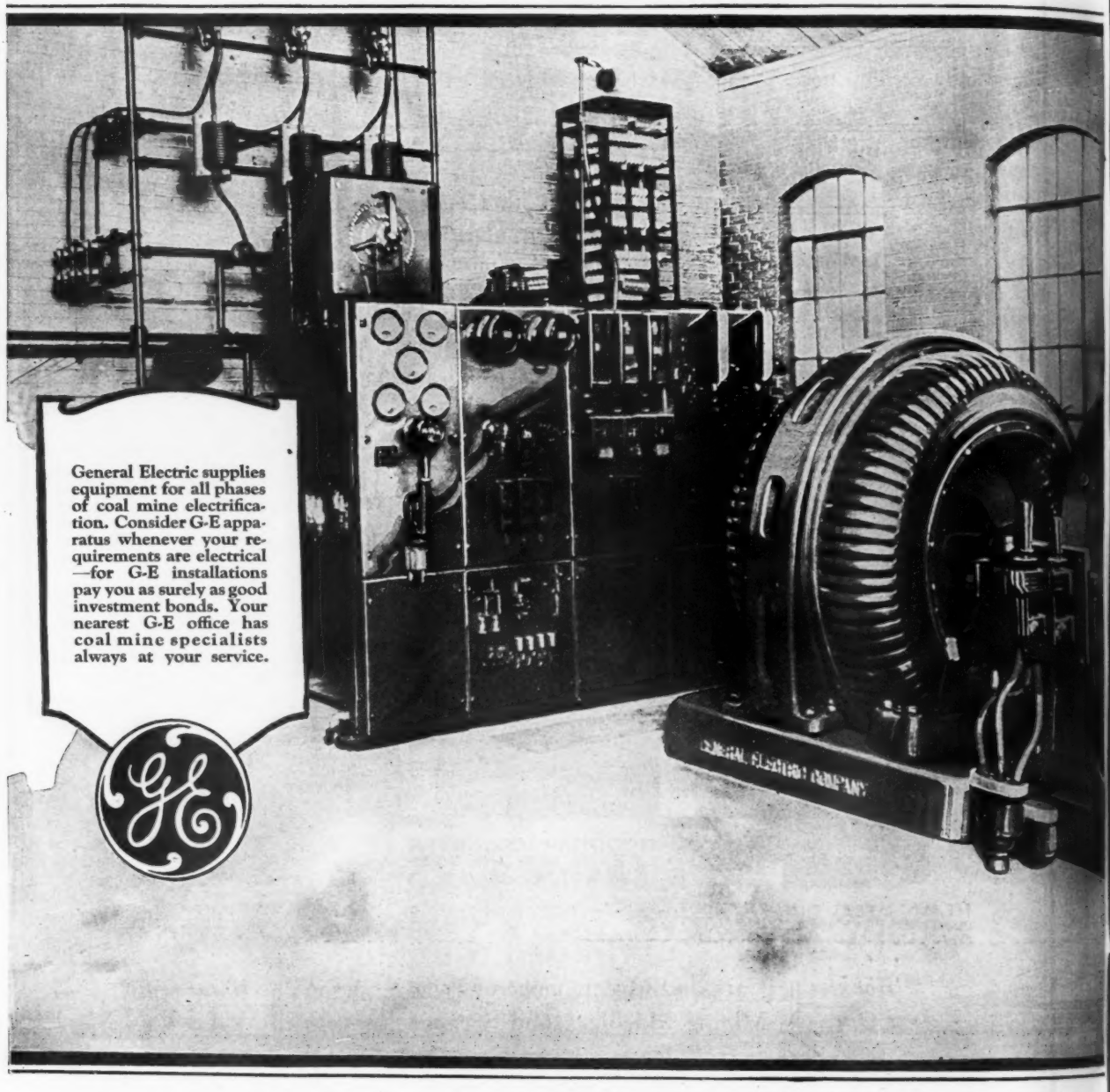
New Booklet Just Out || Care and Maintenance of Wire Rope on Mining Machines and Scraper Loaders || *Want One? Ask Us*

GOODMAN MANUFACTURING COMPANY

PITTSBURGH CHARLESTON, W.VA. ST. LOUIS DENVER 4746 to 4854 South Halsted Street CHICAGO, ILL. CINCINNATI HUNTINGTON, W.VA. BIRMINGHAM

1100

Keep Power Circuits



General Electric supplies equipment for all phases of coal mine electrification. Consider G-E apparatus whenever your requirements are electrical—for G-E installations pay you as surely as good investment bonds. Your nearest G-E office has coal mine specialists always at your service.

GE

GENERAL

GENERAL ELECTRIC COMPANY, SCHENECTADY, NEW YORK

Alive Automatically

Get Full Rated Capacity from every machine

Your mine equipment cannot deliver full rated capacity unless your power circuits are always on the job—and deliver power at the proper voltage.

G-E Automatic Substations improve lagging power-factor, bolster up weakened lines, localize trouble, speed up mining equipment, increase tonnage, cut costs immeasurably and often *pay for themselves* in a short time.

Advantageous location and the elimination of the human element permit the use of automatic substations where manually operated substations are impractical.

Wide experience in direct-current distribution systems for underground workings enables G-E engineers to fully advise you on the installation of Synchronous Motor-Generator Sets, Rotary Converters, Automatic Reclosing Equipment and Switchboards—or complete Automatic Substation Equipment.

GENERAL ELECTRIC

SALES OFFICES IN ALL LARGE CITIES

48-3

High School, McAlpin Coal Co., McAlpin, W. Va.

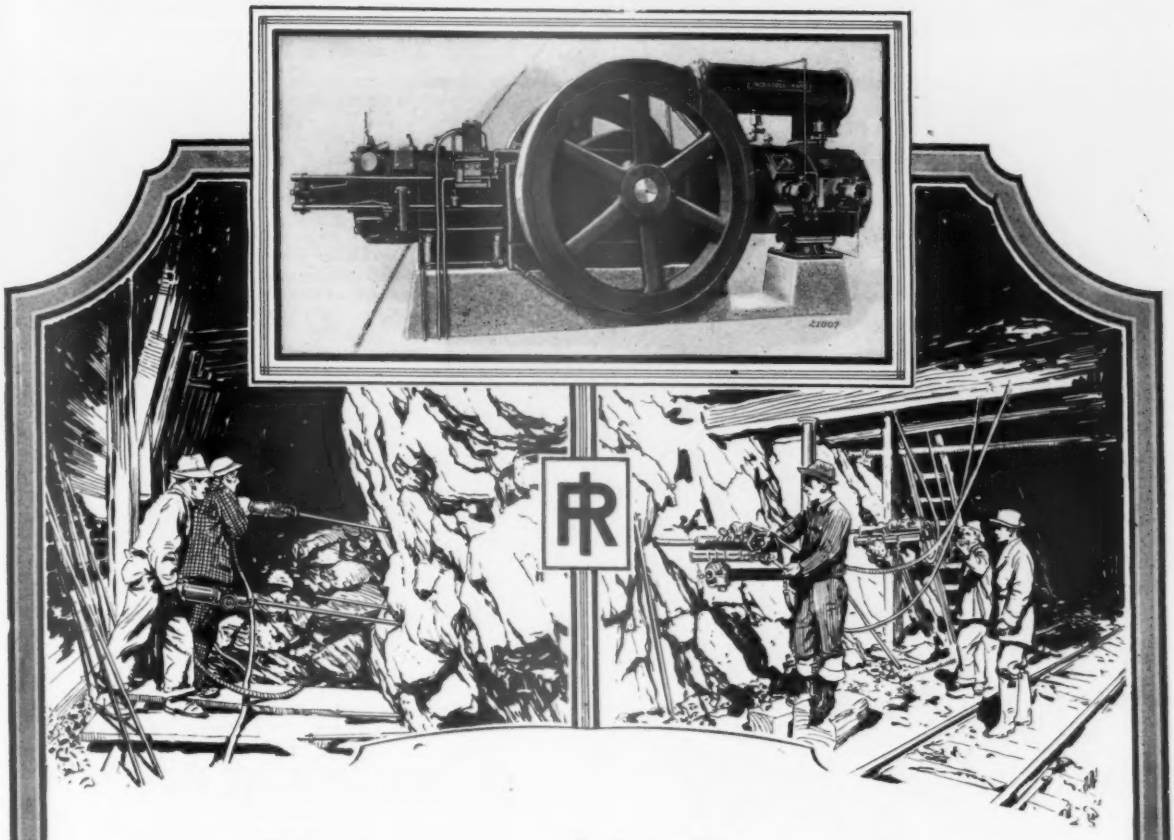
Our Great Industrial Need

Never before in the mining industry has there been such a need for complete understanding among those who employ and those who work. The entire anthracite coal mining industry is closed down because workers and management cannot get together. In the bituminous field labor relations have been the subject of almost continuous controversy.

Our great industrial system has crowded farther and farther apart the people who pay wages and the men who receive them. Organized workers and organized employers banded together to defeat the purpose of each other will never solve the industrial problem. But organized workers and organized employers, banded together for the mutual benefit of each other, will solve it.

Our Great Industrial Need is Cooperation. Industrial peace will not be reached through legislation; through compulsory arbitration or organized minorities attempting to force their dictum.

Miners' Homes, Spencer Fork Coal Co., Whitby, W. Va.



Cheaper Air Power
with an
I-R Oil Engine Air Compressor

The Ingersoll-Rand Type "POC-2" Oil Engine Air Compressor illustrated will operate a 10-hour shift at full load on 60 gallons of fuel oil and ½ gallon of lubricating oil.

With fuel oil costing 6 cents per gallon and lubricating oil 60 cents per gallon, the operation cost of a 10-hour shift is $4.00.

At full load will furnish sufficient air for operating continuously three R-72 "Leyner-Ingersoll" Drifters or eight BCR-430 "Jackhamer" Drills.

These oil engine air compressors are rugged, simple, and reliable. They are the cheapest source of air power. Skilled operators are not required.

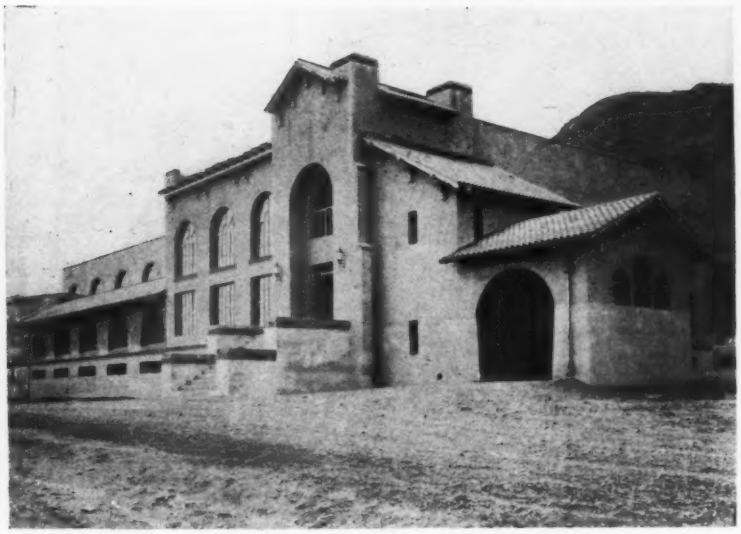
INGERSOLL-RAND COMPANY—11 BROADWAY, NEW YORK CITY.

Offices in principal cities the world over

FOR CANADA REFER-CANADIAN INGERSOLL-RAND CO. LIMITED, 260 ST. JAMES STREET, MONTREAL, QUEBEC.

Ingersoll-Rand

75-SO-E.

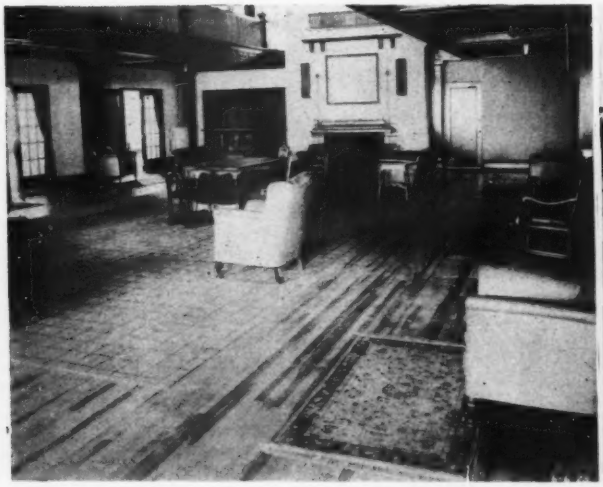


New Club House for Utah Copper Employes

A Co-operative Investment

In dollars and cents the building of this beautiful Club may register a poor return—

But in solidifying community interest the Utah Copper Company and its employes will realize something not attainable by mathematical calculation.



Interior the Utah Copper Club

Panoramic View of The Central Steel Company's Mills, Massillon, Ohio

Our Blast Furnaces and By-Products Plant, now building

Where UMA Steels Are Made

UMA steels are made in the most modern steel plant in existence—a plant producing more alloy steels than any other in the world. Nowhere will you find better and more modernly equipped laboratories nor a more experienced and skillful staff of metallurgists and practical steel men. It is the only plant producing UMA steels—a series of specially treated steels of the highest type, "tailor made," if you please, to meet specific, rigid and exacting requirements. Send for a copy of our Agathon Alloy Steel handbook giving physical properties of our entire UMA series.

We also have daily production in all kinds of Agathon Alloy Steels such as—

Nickel, Chrome-Nickel, Molybdenum, Chrome-Molybdenum, Nickel-Molybdenum, Vanadium, Chrome-Vanadium, Chromium, etc.

Deliveries in Blooms, Billets, Slabs, Hot Rolled, Heat Treated, and Cold Drawn Bars, Hot Rolled Strips, etc.

THE CENTRAL STEEL COMPANY, Massillon, Ohio

Swetland Bldg., Cleveland — Book Bldg., Detroit — Peoples Gas Bldg., Chicago
Aeolian Bldg., New York — University Block, Syracuse — Widener Bldg., Philadelphia
303 W. P. Story Bldg., Los Angeles, California

UMA ALLOY STEEL

CONVEYING MACHINERY

A Few of Weller Products

APRON CONVEYORS	BUCKET ELEVATORS	SCREENS
BELT CONVEYORS	ELEVATOR BUCKETS	GRIZZLIES
BUCKET CONVEYORS	SKIP HOISTS	SPROCKETS
CHAIN CONVEYORS	WEIGH LARRIES	GEARS
SPIRAL CONVEYORS	COAL CRUSHERS	BEARINGS
FEEDERS (ALL KINDS)	CAR HAUL CHAIN	BINGATES

SHEET METAL AND STRUCTURAL STEEL WORK

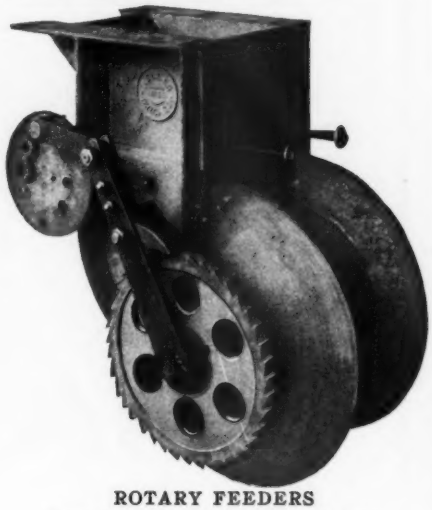
Catalogs on Request

WELLER SPIRAL CONVEYORS

Cold Rolled Steel, Sectional Flights, Wear Long

We Also Make

Spiral and Ribbon Conveyors of Monel Metal



ROTARY FEEDERS

Large Capacity Adapted for Material Over 6 inches in Diameter

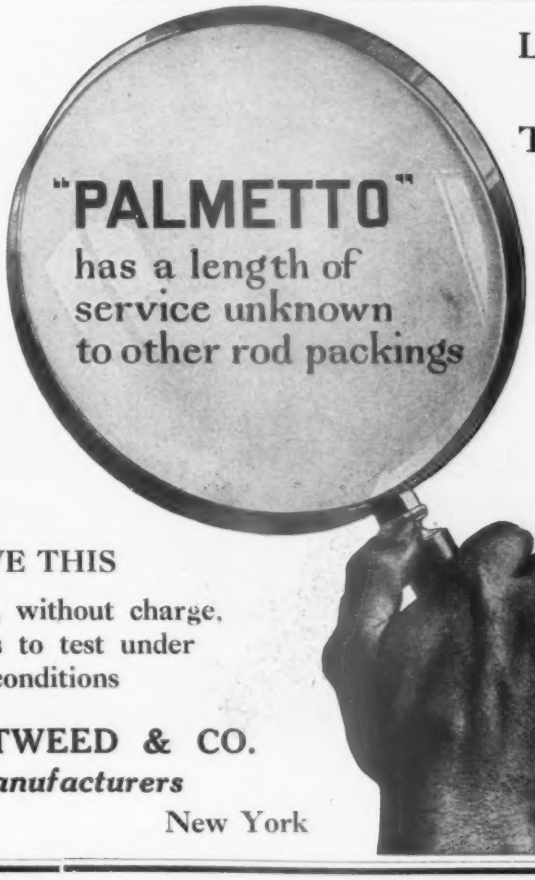
WELLER MFG. CO.

1820-1856 N. KOSTNER AVE. CHICAGO, ILL.

Sales Offices

NEW YORK BOSTON BALTIMORE BUFFALO PITTSBURGH DETROIT
ST. LOUIS OMAHA SALT LAKE CITY SAN FRANCISCO

LONG SERVICE
MEANS
TRUE ECONOMY

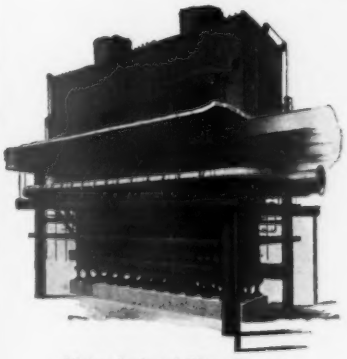


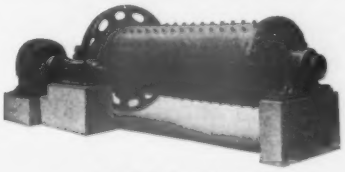
TO PROVE THIS

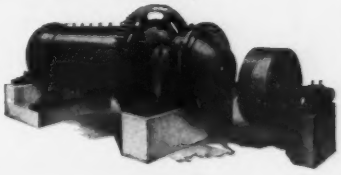
We will send you, without charge, working samples to test under your own conditions

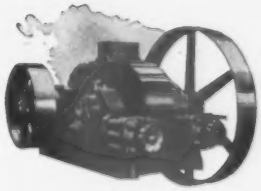
GREENE, TWEED & CO.
Sole Manufacturers
109 Duane St. New York

MACHINERY
—FOR—
MINE——MILL——SMELTER
Embodying Recent Developments and Latest Design

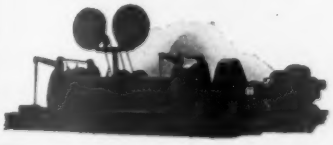

Water Jacketed Blast Furnace


Ball Peb Granulator


Rod Mill


Crushing Rolls

Ball Granulator


Double Drum Electric Hoist

ALLIS-CHALMERS
MILWAUKEE, WIS. U. S. A.

TELLURIDE—ONE OF THE MANY

Creating National

Possibly no State in the Union has such a diversity of minerals as Colorado. Some 250 useful metallic and non-metallic minerals have been discovered in sufficient quantity to justify development. The State abounds in mineral production, the principals being gold, silver, coal, copper, zinc, lead, radium, tungsten, manganese and gypsum. Fuel is abundant, development rapid and production great. Colorado has been a gold producer since 1858, and ranks second in output, with a production up to September, 1924, in the amount of $685,000,000. Silver production for the same period is valued at $515,000,000.

The coal fields cover approximately 19,000,000 acres, and the available coal supply is 317,500,000,000 tons. Zinc ranks second in annual volume of output.

The oil shale deposits cover an area of 2,500 square miles. The estimated recoverable oil is 58,000,000,000 barrels, with a corresponding estimated recovery of ammonium sulphate of 300,000,000 tons.

The State stands first in the production of radium, uranium and vanadium and second in the production of tungsten.

MINING CENTERS OF THE STATE

Wealth In Colorado

COAL:

9,840,000	Tons produced 1923.
$33,299,000	Value of production.
12,378	Men employed in industry.

GOLD AND SILVER:

(GOLD)	(SILVER)	
408,667	3,286,996	Ozs. produced in 1923.
$6,591,629	$4,374,280	Value of production.
3,495		Men employed in industry.

LEAD:

23,010	Tons produced in 1923.
$3,198,873	Value of production.
468	Men employed in industry.

ZINC:

27,076	Tons produced in 1923.
$3,682,336	Value of production.
539	Men employed in industry.

RADIUM, TUNGSTEN, MANGANESE, GYPSUM AND ALL OTHER MINERALS (exclusive of petroleum):

1,625,995	Tons produced in 1923.
$10,233,028	Value of production.
1,498	Men employed in industry.

Du Pont chemical engineers insure uniformity of quality by chemical control through every step of manufacture from raw material to finished product.

DU PONT

Why It Pays To Use Reliable Accessories

Complte detonation of an ***explosive charge is the end*** of a perfect shot! So much depends upon the action of blasting accessories—cost of explosives, expense of directing, drilling and loading and the desired results—that explosives users cannot afford to imperil the success of their operations by resorting to the use of inefficient blasting accessories. Du Pont Blasting Accessories are designed, made and guaranteed by the du Pont Company, manufacturers of explosives since 1802. When you order blasting accessories, specify du Pont to insure complete detonation—the end of a perfect shot!

Look for the du Pont "oval" on the container of the following efficient and dependable du Pont Blasting Accessories:

- Blasting Caps
- Delay Electric Blasting Caps
- Blasting Machines
- Galvanometers
- Leading Wire
- Electric Blasting Caps
- Fuse
- Delay Electric Igniters
- Rheostats
- Cap Crimpers
- Tamping Bags

Write for Blasting Accessories Catalog containing descriptions and illustrations of du Pont accessories and practical information about their use.

E. I. DU PONT DE NEMOURS & CO., Inc.
Explosives Department
WILMINGTON, DELAWARE

Branch Offices:
Birmingham . . Ala.
Boston . . . . Mass.
Buffalo . . . . N. Y.
Chicago . . . . Ill.
Denver . . . . Colo.
Duluth . . . . Minn.
El Paso . . . . Tex.
Huntington . W. Va.
Joplin . . . . Mo.
Kansas City . . Mo.
Mexico City . . Mex.

Branch Offices:
Miami . . . . . Fla.
New York . . . N. Y.
Pittsburgh . . . Pa.
Portland . . . . Ore.
St. Louis . . . . Mo.
San Francisco, Calif.
Scranton . . . . Pa.
Seattle . . . . Wash.
Spokane . . . . Wash.
Springfield . . . Ill.
Du Pont Products Exhibit, Atlantic City, N. J.

POWDER MAKERS SINCE 1802

The
MINING CONGRESS JOURNAL

PUBLISHED EACH MONTH BY THE AMERICAN MINING CONGRESS MUNSEY BLDG., WASHINGTON, D. C.
Subscription Rate: Per Year, $3.00 Single Copies: $0.30

VOLUME 11 OCTOBER, 1925 NUMBER 10

A NEW TAX PROGRAM

THE congestion and confusion existing in the Income Tax Unit, due to the failure of the Unit to make its tax settlements final, must be remedied. The present system of arbitrary assessments, reaudits, revaluations, rehearings, and additional assessments, must be abandoned. Otherwise, the administrative machinery will break down. With thousands of new cases being added annually to the unsettled cases already accumulated during the last seven years, it is apparent that something will have to be done.

It has been pointed out repeatedly in the columns of this Journal that the principal fault lies in the revenue laws and not in the Treasury Department. Each new law has introduced new technicalities and new complications into the revenue administration. The tendency of Congress has been to confound administrative difficulties rather than simplify them. The proposed Revenue Act of 1926 may prove an exception. Certainly, Congress should devote special attention to the simplification of the administrative provisions of the law.

The present situation was foreseen in 1918 by the representative of the American Mining Congress, who suggested to the Finance Committee of the Senate *"that settlements made by the Treasury Department in good faith and where all the facts have been presented by the taxpayer should be considered as final settlement. It seems but fair to business interests that after meeting all requirements they should know that the matters are finally determined. * * * The fact is that there is no assurance that those settlements are final."*

The apprehension of the American Mining Congress in 1918, that tax settlements made then with the Treasury Department would be subjected to readjustments by future officials of the Department, has been justified over and over again by subsequent events. Thousands of cases have been reopened again and again as new auditors, engineers, and field agents of the Department have arrived at different conclusions on the same facts; and as new laws have made necessary the promulgation of new regulations and new interpretations that became retroactive in their application. Congress could have prevented most of the trouble then. Congress can correct most of it now.

But Congress must abandon the idea that seems to have prevailed in the past that amendments to the law must be principally for the purpose of closing alleged gaps or loopholes for tax evasion. Most of the alleged tax evasion has existed in theory and not in fact. And if Congress will work for and accomplish simplification, the alleged loopholes will disappear. The simpler the law and its administration, the less opportunity there will be for technical loopholes to creep in. The law can be simplified, and when that is accomplished it will be easier and less expensive to administer, and taxpayers will not be subjected to such enormous expenses in complying with its requirements.

Congress, in framing the last revenue law, gave more attention to surtax rates than to the administrative provisions. In framing the next law, the question of maximum rates should take second place, since there seems to be substantial accord among the several political groups as to what the rates should be. Therefore, taxpayers may hope, and perhaps not in vain, for the amendment of the law along constructive and simpler lines.

Repeal of taxes which make necessary more than one return, such as the capital stock tax; repeal of the retroactive provisions of the reorganization section which tend to penalize taxpayers for having made necessary business reorganization during the war to meet the demands of the nation, and during the deflation period following the war in order to obtain needed capital and perhaps prevent bankruptcy; a definite provision of law making tax settlements final where all the facts have been submitted, considered, and once agreed upon; repeal of the publicity provision; and the granting of broader powers to the Board of Tax Appeals. These are a few of the changes that will improve the revenue law. They can be secured if taxpayers will unite in demanding them.

THE ELEPHANT FALTERS

THE Hoch-Smith resolution has created a condition of national uncertainty in matters of railroad transportation. That resolution directed the Interstate Commerce Commission to investigate the general rate structure of the railroads and to make such changes and readjustments as might be found necessary to correct any defects therein. The Commission was directed specifically to effect with the least practicable delay such lawful changes as will promote the freedom of movement by common carriers of the products of agriculture, including live stock, at the lowest possible lawful rates compatible with the maintenance of adequate transportation service.

When Congress passed this resolution, the idea that prevailed generally among its members was that rates on agricultural products, and perhaps on some other commodities, were too high and could be reduced; and that some rates were too low and could be increased. It was placed squarely up to the Commission to decide what rates could and should be reduced and what rates could and should be increased.

The Commission immediately took steps to initiate this investigation; but these steps were vague and uncertain and suggestive of a groping circus elephant at a bridge approach who, though anxious to obey his trainer or keeper, seeks to test each yielding plank before attempting to cross the stream. The Commission thinks it knows what the Hoch-Smith resolution calls for, but it has a bridge to cross that may not bear the strain.

No one knows what may be done. The Commission does not know, and shippers are equally helpless. Meanwhile, the railroads are not standing by waiting for their

rates to be slashed. The western roads have taken the initiative. They can make the best showing for increased rates. It is in their territory that the largest initial movement of long-haul agricultural traffic takes place. It would not serve their best interests to wait for the Commission to act, and trust to luck that their freight revenues would not be reduced by rate readjustments that might result from the investigation; therefore, they applied for an increase in revenue. Conditions are such that an increase in revenue may be justified. The western roads took the wise course in making this move.

But where does this leave the shippers, particularly those in western territory? They are placed on the defensive. They must show that the evidence submitted by the carriers in justifying their application is wrong and that the plan of relief proposed, it being generally recognized that the western carriers need relief, is not the best possible plan by which that relief may be granted by the Commission. Thus, instead of the Commission being permitted to proceed in its own way in carrying out the directions of the Hoch-Smith resolution, the question of what shall or shall not be done has become a vital issue, with the carriers on one side demanding rate increases; with the shippers on the other side seeking to prevent increases; with Congress, who started the whole business, on the side lines ponderously preparing to deal with other matters; and with the possibility of rate reduction vanishing into thin air.

No accurate prediction can be made on the final outcome of the Commission's investigation, which hardly has reached its preliminary stages. The action of the Commission thus far has consisted of a few gestures in the form of announcements and of requests for suggestions from the representatives of the railroads and the shippers. No one knows precisely where the actual investigation will begin and no one knows even remotely where it will end. Everyone is entitled to a guess. And as good a guess as any is that unless Congress repeals the Hoch-Smith resolution, the investigation will end with an increase in the general level of freight rates.

FIGURING THE TRUTH

THE public has been deluged for the past five years with statements purporting to show the extra-hazardous situation of the coal miner. These statements have emphasized the tremendous "risk" to life; the hardship of working underground, and the relatively poor return considering all these things.

If we may use the interesting old platitude—figures do not lie—as a gauge, the coal miner hasn't so much to complain of when he is paralleled with other industrial workers. In a recent comparative analysis of coal mine and other workers, Dr. Henry Mace Payne, consulting engineer to the American Mining Congress, gives figures that are enlightening. This statement, in part, says:

> "There is no occupation which offers more uniform temperature, day and night, summer and winter, than coal mining. Where the ventilation is normal, the temperature of working places and return air current shows no appreciable variation.
>
> "Coal mines are required by law to supply from 100 to 200 cu. ft. of air per man per minute; and 300 to 500 cu. ft. of air per mule per minute. Yet many a miner after working in good pure air all day, unaffected by hot sun or frosty blast, sleeps in a room 16x10x8 feet, or less, with windows closed.
>
> "Air, at average mine temperature, weights .08 lb. per cu. ft. The average anthracite mine forces two tons of air per minute through its workings. To do this, requires expensive fan installations and a substantial amount of power, day and night.
>
> "Glass workers, foundry men, lumber mill operatives and loggers, all are subject to the rigors of climate. Textile employees, by the nature of their product, must work in a highly humidified room. Yet a study of Bulletin 265, of the Bureau of Labor Statistics, shows as the result of investigation in from 30 to 144 establishments, covering from 1,700 to 40,000 employees, the following average earnings per hour worked:

Lumber	$.359
Logging	.436
Brick and Tile	.469
Glass	.498
Paper and Pulp	.498
Foundries	.548
Anthracite coal	.616
Bituminous coal	.720
Iron and Steel	.734

> "The removal of water also demands elaborate pumping equipment and never-failing power in considerable quantities. The average anthracite mine pumps from 11 to 12 tons of water for each ton of coal produced. One property pumps 40 tons of water per ton of coal.
>
> "To supply this power, for hoisting, ventilating, pumping, lighting, screening and washing, the anthracite companies consume 9,000,000 tons of coal per year; while the product of 3,800 acres of forest is annually consumed underground, as timber; and 25,000 *tons* of explosives are used to break down the coal and to drive 200 miles of underground headings and gangways per year, in development work.
>
> "In 1913, the anthracite companies paid in capital stock tax, tonnage tax, county, municipal, school and poor taxes, $5,850,960; in 1921 this amount had increased to $16,143,953; while in 1922, notwithstanding a 31 percent reduction in output, the total state and local taxes paid amounted to $19,870,620. It should be noted that Federal taxes are not included in these figures, as they are deducted from income.
>
> "Where, as is frequently the case, the operation is under a city or village, it becomes necessary to mine only the original entries and air courses, which must then be filled with noncombustible material such as sand or gravel, pumped into place by the 'flushing' process, and allowed to settle and pack, thus supporting the surface from subsidence. The water from this material must also be pumped out.
>
> "When the filling is sufficiently packed, the intervening blocks of coal may be divided and removed, and this space, in turn, flushed full for support of overlying strata. In some mines the process must be repeated from three to four times before the available coal can be recovered. All this adds to the expense of mining.
>
> "So, whether the miners see fit to work or not, pumping, timbering, ventilation, sandpacking, all must go on. This overhead expense approximates $200,000 per day, to offset which not a pound of coal is leaving the ground, and 147,500 men, whose daily wage aggregates $1,250,000, are foregoing any further income.
>
> "It is now fifteen years since the efficiency en-

gineer came to the front. Standardization in methods and in production occupies the attention of great national societies. The elimination of waste, both in industry and in government, claims the front page of our daily newspapers. But this great economic waste of investment, this terrific loss for plant maintenance, this sacrifice of earning power, inexorably continues. If a gigantic pumping plant were in continuous operation, and irrigating ditches were being maintained, with water flowing idly through them and wasting, while farmers went off on vacations and necessary foodstuffs died for want of water, public opinion would be loud and outspoken.

"The records of the U. S. Coal Commission show that the anthracite miners who worked full time in 1921, (the latest year of normal production for which statistics are available) earned more than $2,700 per year, while their helpers averaged more than $2,100 per year. Under the 1923 award these men now get 10 percent more. Comparatively few miners consent to work full time at present high rates of pay, notwithstanding the favorable conditions under which they labor, as compared to those in many other industries.

"The situation is no different from that which is related by Walker in 'The Things That Are Caesar's,' wherein two hunters having captured a fawn, divided the flesh between them. The one ate his fill and threw the balance to the wolves. The other carefully cached his on a tree limb. Several days later, food being scarce, the second man returned and satisfied his hunger, while his companion begged for a share. The saving of the uneaten food was the beginning of wealth. The application of this principle to the anthracite miner is obvious."

After all *is* his lot so difficult?

THE INEVITABLE DENOUEMENT

THE strike of the miners' union in the anthracite field is now a fact. For that strike there was no provocation, no excuse and no justification. The operators had yielded to powerful influences when they granted the existing wage scale. To do so, was against their business judgment. They could not go further. That is, in 1920, President Wilson appointed the U. S. Anthracite Coal Commission. In its report, that commission ventured to use this powerful language:

"The Commission approves the request for recognition of the United Mine Workers * * * * and *directs* that the form of contract entered into * * * * shall be between Districts 1, 7 and 9 of the United Mine Workers of America * * * *."

It is a grave question where any federal commission got its power to "*direct*" what the terms of a private wage contract should be. Even so, this language was employed and the operators had to do as directed or take a position squarely against the President of the United States. Also, when they granted the present scale, in 1923, the operators acted in accordance with a direct award made by the Governor of Pennsylvania. A command from *such* a source was not easy to avoid. However, by acting upon these powerful commands, the operators understood that their costs and hence their selling prices had been carried far beyond the level which the public would pay without complaint. There was ample evidence of the dissatisfaction of the public. Many groups representing the consumer had tried to find relief from the oppressive prices and when this was not obtainable in any broad way, the individual consumers had begun to apply their own remedy, which was to turn to other fuels. It was obvious that the public would not stand any further increase in price, a fact which was known fully to the miners. When, therefore, the miners tried for another increase, the strike in support of those demands was naked of any excuse for its existence.

It is too well established, now, to need any substantiation that the miners were not aiming at the anthracite situation at all. What they wanted to do was to bolster up their failing situation in the bituminous field. The Jacksonville scale was rapidly sinking into disuse because the consumers refused to pay it. And, as the scale went down, the union was going down with it. That being true, the anthracite strike is a mere prelude to something else which the union has in mind, and that other something is beginning to develop. Specifically, the union has, already, renewed its efforts to unionize the Fairmont region of West Virginia and has attempted to extend that strike into other portions of that state. The Fairmont district is what might be called a strategic situation. It comes directly into contact and competition with central Pennsylvania to the north; with western Pennsylvania, a next door neighbor; and with the high volatile field of West Virginia immediately to the south. The union cannot expand or attempt to expand into one of these fields without attempting also to command the situation in all three of them.

For the immediate purpose it is enough to say that the effort to unionize Fairmont makes it unavoidable that the union shall try to strengthen its failing grip on western Pennsylvania, and, the moment it enters that field, with a strike order, it has violated and torn up the contract with the Central Competitive Field, of which western Pennsylvania is one of the commanding portions. To strike the Central Competitive Field is to attempt to reinstate, with full force and effect, the discredited Jacksonville agreement.

This plunges into a situation which demands immediate attention. Since the Jacksonville scale was signed, by what was then an organized group of operators, the Central Competitive Field has practically been disrupted. It seems unlikely now that, as a force in labor negotiations, it will ever be reconstituted in its old form. Under the influence of the Pittsburgh Chamber of Commerce, the western Pennsylvania operators have cut themselves loose from any national organization of operators for the purpose of dealing with labor. And, the miners are cutting themselves loose from their international union. Without Pittsburgh participating, Ohio cannot remain a part of the Central Competitive Field, and without those two districts, the negotiating organization of the operators is gone.

With the public resenting the result of the anthracite wages; with the bituminous operators' organization disrupted; and with the union disintegrating, it must be apparent that the union officials have a major task of salvage to perform. For that reason their measures may be expected to be heroic, even to the point of being desperate. If, then, the present strike shall envelope the bituminous field, it will be but a natural denouement.

DIFFERENT BRANDS OF THE SAME ARTICLE

DR. GEORGE OTIS SMITH in a recent address said that there are "two kinds of conservation—one practical, the other political."

The mining industry is very familiar with the brand known as political. Alaska is a startling example of just what political conservation can do. No sensible person objects to practical conservation. The policy of the government in preserving for future use large areas to be used as national parks has certain things in its favor. But those certain things do not obliterate the great principles established by our forefathers in developing the natural resources of the country. So far in our history, political conservation (otherwise political control) of any national asset has demonstrated but one thing: The impossibility of making a success of the thing attempted. Dr. Smith says that "the political mind desires to distribute wealth," and the editor of the Wall Street Journal amplifies that statement by saying that "the political mind fails to see that it must create wealth before it can distribute it."

The mining industry in the period of its greatest growth was encouraged by the government; it was offered large returns for the courage, hardship and ability required to find and develop the nation's mineral resources. If the mining industry had depended upon the government to develop those vast mineral areas between the Mississippi and the Pacific it is a certainty that the great copper deposits of the West would still have been unknown; that the gold California has given would not have been added to the national wealth.

Past experience is concrete evidence that no self-governing and free people have ever permanently established and maintained a system of government landlordism, and that the phenomenal success of the mining industry in the United States unquestionably has been largely due to individual ownership, initiative and enterprise.

Conservation—one phase of the political brand—was the fallacious foundation upon which our present leasing system was built. Those who argued so earnestly in favor of a leasing system did so upon the premise that private ownership means waste. They contended that great corporations engaged in producing our minerals were wasting a precious heritage that belonged to all the people. They got what they wanted. The leasing bill has been a law for several years. But with what success? Has it provided the great panacea it was declared to be? Evidence is to the contrary.

Conservation in the political sense means stagnation. Undeveloped natural resources in times of emergency are tantamount to no natural resources. And it is safe to say that for one instance of abuse by private capital of rights accorded it there are thousands of examples of men who have hazarded their all and have given to the nation very real and tangible assets.

In all matters of legislation affecting natural resources, and in particular the mining industry, it will be squarely up to members of the incoming Congress to decide whether that legislation shall be determined upon practical or political considerations. If they are determined upon a practical foundation continued growth and prosperity of our natural resources may be assured; but if political factors govern, the future is more uncertain.

THE ANSWER

THE very general editorial criticisms by the newspapers of the country of both operators and miners as being jointly blamable for the disturbed condition in the coal mining world are somewhat startling to those who know the inside workings of the coal mining business.

Whether this attitude is assumed because the operators are few in number and the miners and their natural sympathizers are many, seems questionable, although this question carries with it a suspicion of the sincerity of the editorial writers of the nation, in presenting the facts. It is generally assumed that the anthracite coal operators are making extortionate profits, and that because of these enormous profits they are in position to grant the extortionate demands of the miners' union by only slightly diminishing their own alleged vast profits.

The annual report of the Lehigh Coal and Navigation Company proves conclusively the contention of the anthracite coal operators. From the report of their last year's operation we quote the following:

Revenue, Coal Sales		$19,523,205.27
Cost of Production of Coal Sold	$19,087,570.68	
Sales and Storage Expenses	336,532.80	19,424,103.48
Net Earnings from Coal		$99,101.79
Non-operating Revenues (net) (Leases, Retail Yards, etc.)		32,172.83
Net Operating Revenue, Coal Property		$131,274.62

Of the $19,087,570.68 for cost of production, $14,417,892 was expended for labor, $2,689,438 for materials, and $1,980,240 for reserves (depletion, depreciation, mining hazards, taxes and insurance).

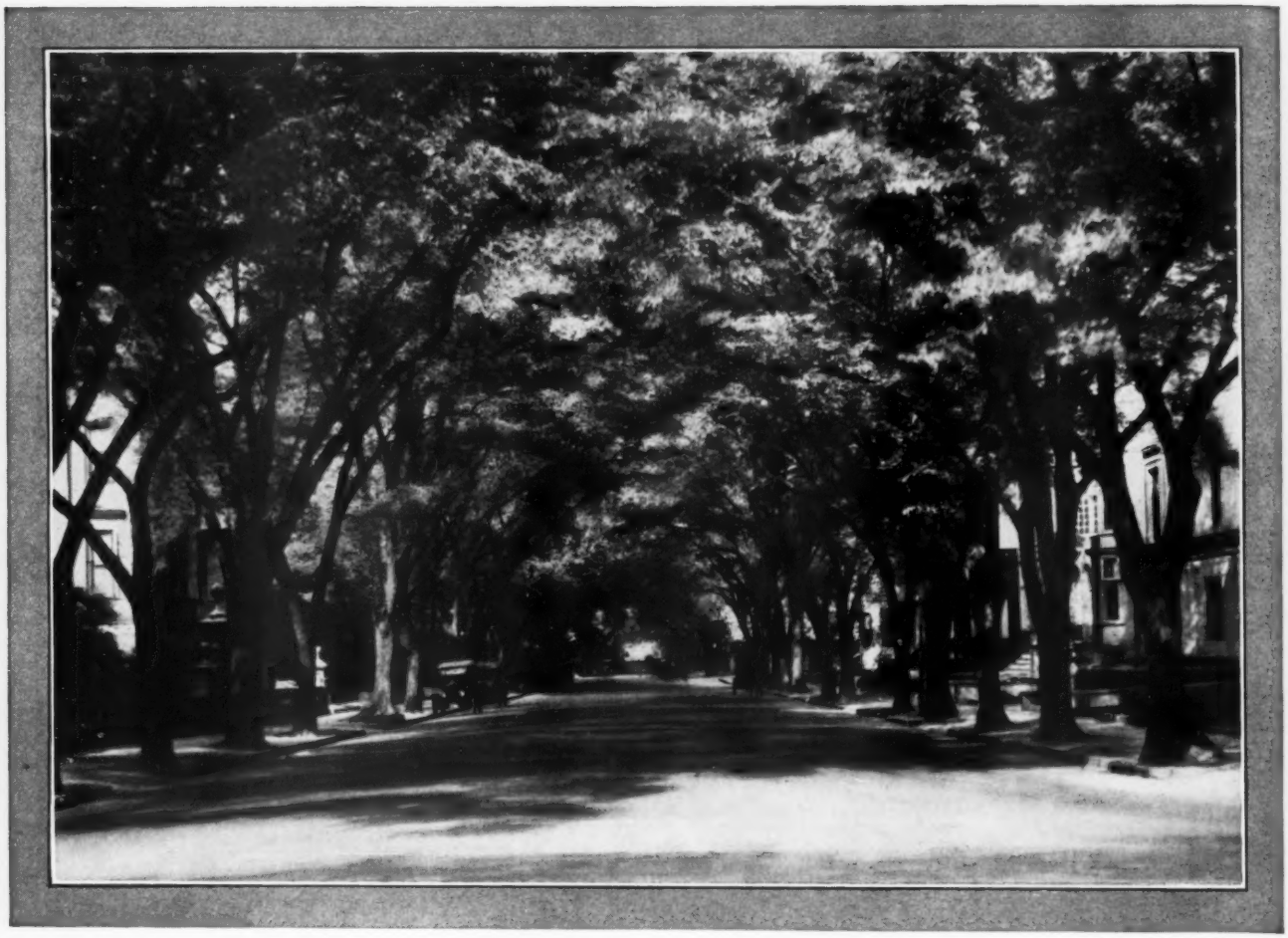
The anthracite industry is gradually losing its markets by the substitution of other kinds of fuel. It can never increase its markets on the one side and in order to hold its present markets it must bring about a decrease in the cost of production. Its position in the present strike from the beginning has been that no proposal would be considered which would increase production costs. The anthracite industry would have been justified in insisting that no proposal would be considered which did not mean a very substantial decrease in production costs.

To assume, as many editorial writers have done, that the blame for the present controversy should rest equally upon the operators and the miners is without justification. *The operators, in the face of the fact that their product could not be sold for more money, would have been justified in declaring a lock-out in order to reduce their expenses to a point where their business would pay a larger profit than shown by the report.*

The operators did not take this position but they did insist that no proposal could be considered which increases the cost of coal while there was no possible method by which to get an increased return with which to meet the increased expense.

Why will not the press face this situation as it is and place the blame for the present labor difficulty upon that branch of the industry which is seeking to enforce impossible conditions upon the operators?

XU



New Hampshire Avenue, at Dupont Circle, Washington, D. C. © *Harold Gray*

"Under the shady roof
Of branching elms star-proof."

WILL THE STRIKE STOP COAL DEFLATION?

To This Universal Question, The Answer Is That The Strike Promises To Check The Inflation, There Having Been No Deflation

By GEORGE H. CUSHING

ANTHRACITE prepared sizes have sold recently for $8.50 and $9 a ton at the mines. Bituminous "domestic" sizes have sold in the market for very much less—perhaps $3.50 a ton was about the top price. Now, the anthracite production is suspended by a strike. Bituminous prices—on the interesting theory that people who have paid $8.50 a ton for one coal will be pleased to get another at a slightly less price—have been edging up toward $5 a ton. Such prices for bituminous are profitable. They promise to lure back into the market some mines which have been closed for over a year. Therefore, everywhere, the question is:

"Will the anthracite strike, by inviting idle mines into production, stop the deflation of the bituminous coal industry? Will it revive mines that were all but dead and leave the industry with its destructive job of killing off unnecessary mines to do all over again?"

The fact that the question is asked frequently and in many parts of the country discloses the belief that there has been some deflation in the bituminous industry—some killing off of unnecessary mines. The really important question from the industry's standpoint is:

"Has there been any deflation at all in the bituminous industry as the result of the two years of wreck and ruin which has spread itself over the coal field? Has there been, by one single ounce, a reduction in the productive capacity of the bituminous field?"

A single thoughtful inquiry will disclose that there has been no reduction in the productive capacity of the coal mines as a whole. Instead, there has been a steady and a truly alarming increase in that capacity. That being true, the truly pertinent question is:

"Will the anthracite strike stop the *inflation* of the bituminous industry?"

When the solemn fact is that one-third of the bituminous industry has become insolvent in the last two years and when many operators are far hungrier than their own miners, it seems almost like a cruel joke to say that the departure from the industry of once strong and powerful concerns has not served to relieve the industry of a single ounce of its economic pressure. It seems too horrible to believe that these gentlemen have suffered and have perished entirely in vain—that the industry is as overcrowded as ever and even more so. Still that is the plain truth.

Looking at the facts cold bloodedly, the fate of the man who owns a mine is not and cannot be the fate of the mine. The two are wholly independent of each other. Obviously, if the owner of a mine dies, the mine does not die with him. That one statement dissociates the man and the property. It follows that if the man who owns the mine becomes bankrupt the mine does not perish and fade out of existance. A mine is a hole in the ground; generally it is a concrete lined hole in the ground. It takes something far more than a decree of bankruptcy by the court—quite sufficient to dispose of the operator—to wipe that mine out of existence. That hole in the ground is likely to stay there, even as it was created to stay put. So, the mine owners have "gone broke" and faded out of the picture; some of them may even have blown out their brains. But the hole in the ground remains—a stern and substantial reality. And, given another and solvent owner, the mine resumes activity at the old stand precisely as though nothing had happened.

Indeed, it is the very resuscitation of these old mines under the balmy influence of $5 market prices for coal which raised the question as to whether the "deflation" of the industry would be checked.

At any rate, all of the misery of the operators, in the last two years, has not wiped out any mines—except the few that were about worked out anyhow. Thus it can be counted upon that the productive capacity of the bituminous field is substantially what it was two years ago. Certainly, there has been no decrease.

On the contrary, there has been a tremendous increase in production capacity for the following reasons. The unionized mines have been paying one scale; the nonunion mines have been paying another and a lower scale. Because it could not pay the higher scale and meet the market price, the unionized portion of the Pittsburgh district has been shut down. But those who formerly bought their coal from the Pittsburgh district had to be supplied. Therefore, the nonunion fields of central Pennsylvania and southern West Virginia have expanded. The Fairmont district was partly union and those mines for the same reason have closed. The nonunion mines in the Clarksburg and Morgantown districts have expanded to supply the abandoned markets. The Kanawha district was union and closed, in part; Logan county expanded to take its place in the market. The old Hocking district in Ohio was union and closed in large part. Its place in the market was taken by the Hazard and Harlan field of Kentucky which expanded. A part of the union field of Illinois was unionized and closed. This brought an expansion in the recently-made nonunion district of western Kentucky.

Every bankrupt union operator meant a new or a larger nonunion operation. However, the union mines which were closed were not destroyed; they were merely idle. The new nonunion mines were, therefore, a definite and tangible addition to the total productive capacity of the entire industry. The whole amazing story is told in one figure—the production of West Virginia, two years ago, was about half the productive capacity of the bituminous district of Pennsylvania; today, West Virginia is producing more bituminous coal than Pennsylvania.

The answer to the seeming riddle is supplied by the conservative Chamber of Commerce of the United States which, in a deliberate paper signed by two sober gentlemen, says that the non-union fields with 30 percent of the miners is producing 70 percent of the bituminous coal. The union field with shiftless workers could not hold the market against that marvelous exhibition of the efficiency on the part of the nonunion miners.

But, at any rate, there has been no deflation of the bituminous field. Instead, there has been an alarming inflation in that industry brought on by the very means which were employed to bring the old inflation—a pigmy compared with the present giant—to an end. It is for this reason that the question arises:

"Will the anthracite strike stop the inflation of the bituminous coal industry?"

That salutary result seems entirely possible for the reasons about to be given. What has been holding the union production in suspense while the nonunion field was expanding into an all-but-abandoned market was the fact that the union mines had to pay a higher wage than the nonunion mines. What held the wage at that level was the existence of the miners' union. What caused that union to take that suicidal position was the character of its leadership. And, what gave that leadership its power was its ability to browbeat and frighten public men into acquiescence in its demands (*Continued on page* 498)

WESTERN MINING MEN PLAN CONVENTION

Western Division Of The American Mining Congress Will Hold Fifth Annual Convention At Phoenix, Arizona, In November—Excellent Program Including Important Metal Mine Problems Arranged—Special Entertainment With Trip Over Apache Trail To Be Feature Of Meeting

THE western mining conference and the annual meeting of the Western Division of the American Mining Congress will be held in the San Marcos Hotel at Chandler, a suburb of Phoenix, November 16, 17, 18 and 19.

The steady development and growth of the American Mining Congress in its position as the national clearing house for all phases of the natural resources industry has made it advisable to arrange for annual meetings of the various divisions representing different branches in order to discuss the problems of essential importance to these branches and to formulate an expression of the opinion of the mining men of these different phases in order to correlate these policies with the national work of the organization.

The meeting in Arizona will be essentially a western mining conference devoted exclusively to the consideration of the essential problems of western mining. The meeting will be national in scope, but it affords an opportunity for western mining men to meet together and to work out their own problems and formulate a program for presentation for adoption at the annual policy convention of the American Mining Congress which will be held later in Washington, D. C.

The western mining industry is fundamental to national prosperity. Its problems, both of a national and local character, are interlocked with the commercial and industrial interests in the western mining states. The purpose of the Arizona conference is to bring together representative delegates from all of the western mining states in order that there may be a free and frank discussion of their mutual problems and the formulation of resolutions covering their requirements in connection with the carrying on of the work of the national organization.

The arrangements for the Arizona meeting provide for a general session and for a considerable portion of the time devoted to informal group discussions of various phases of western mining as well as an extremely picturesque, valuable and interesting trip of inspection over the famous Apache Trail from Phoenix to Globe and Miami, and a consideration of a number of the practical operating problems which have been successfully solved in Arizona mining enterprises.

General Program

The general program of the Arizona meeting will include a discussion of the salient problems of western mining, and there will be a presentation of the point of view of leaders in the industry in regard to these matters. Generally speaking, there will be four main topics handled in the discussion at the San Marcos Hotel.

1. A consideration of the point of view of western mining in regard to the proper functioning of the Bureau of Mines.

The recent transfer of the U. S. Bureau of Mines from the Department of the Interior to the U. S. Department of Commerce has attracted much attention among mining men. L. S. Cates, president of the American Mining Congress, is a member of the advisory committee appointed by Secretary of Commerce Herbert C. Hoover to cooperate with him in the formulation of a sound and constructive policy for the Bureau of Mines. J. F. Callbreath, secretary of the American Mining Congress, has been the alternate for L. S. Cates on the committee, and these two gentlemen will present their point of view and the work of their committee at the Phoenix conference. This session should be of particular interest and value to western mining men.

2. The position of silver and the development of work for the silver producers.

All mining men in the West are interested in connection with the maintenance and continued development of the silver mining industry, and appreciate the problems which are presented to silver producers. Representative leaders in the silver industry will present their viewpoint in regard to this work and the plans for the further development of ways and means to stimulate and maintain silver production throughout the West.

3. Federal valuation and taxation of mines.

The western mining industry is particularly interested in the application of the Federal internal revenue law as applied to taxation. There will be no special tax conference at the Arizona meeting, but there will be a timely presentation of various aspects of Federal valuation and taxation of mines by representative men from different districts in the western mining states.

4. Railroad freight rates.

The entire transportation situation and the relationship between the mining industry and the railroad enterprises is of fundamental importance and arrangements have been made whereby there will be a timely discussion of the subject of railroad freight rates as applied to the western mining states by a representative attorney thoroughly familiar with the situation and in a position to point

Left—San Marcos Hotel in Chandler, a suburb of Phoenix, where the annual meeting of the Western Division of the American Mining Congress will be held November 16 to 19. Right—A street scene in Phoenix

FEATURES OF PROGRAM FOR WESTERN MEETING

The viewpoint of western mining in regard to proper functioning of The United States Bureau of Mines.

The position of silver and the development of work for the silver producer.

Federal Valuation and Taxation of Mines.

Railroad freight rates.

Practical operating problems;

- ***1—Handling materials.***
- ***2—Underground haulage and hoisting at Inspiration Cons. Copper Company.***
- ***3—Transportation and distribution of underground supplies at Miami Copper Company.***
- ***4—Handling ore and waste at the Magma Mine.***

Apache Trail trip as guest of Arizona mining men.

out some of the cooperative moves which can be made.

5. Practical operating problems.

One session at the meeting will be devoted to the discussion of the practical operating problems of western mining. The general topic for this discussion will be "Handling of Material," and the entire program has been worked out under the supervision of Guy N. Bjorge, associate editor of the MINING CONGRESS JOURNAL. The discussion will include:

1. Underground haulage and hoisting at the Inspiration mines, A. D. Stoddard, Chief Mine Engineer, Inspiration Cons. Copper Co.

2. Transportation and distribution of underground supplies at Miami Copper Company, A. J. McDermott and J. D. Conniff, Miami Copper Company.

3. Handling ore and waste at the Magma mine, F. H. Snow, Mine Supt., Magma Copper Company.

In addition, Guy N. Bjorge will present a brief historical sketch indicating the progress made in the methods of handling material in western mining enterprises.

DELIGHTFUL SETTING FOR MEETING

Arizona in the middle of November is delightful from a climatic standpoint, and the meeting will be staged in a delightful, homelike resort hotel, the San Marcos, at Chandler, Ariz. The business sessions of the conference will be limited, speeches will be cut down to a definite time, and full opportunity will be given for all of the delegates to thoroughly enjoy the opportunities for rest and recreation at the San Marcos Hotel. The morning sessions will be from 10 to 12 o'clock, afternoon sessions from 2 to 4, and there will be plenty of time for informal golf games, automobile trips and other forms of recreation.

The San Marcos Hotel is located 23 miles southeast of Phoenix in the center of the Salt River Valley, which is the most successful and prosperous reclamation project in the United States. The development in the Salt River Valley surrounding Phoenix has been marvelous during the past few years, and every delegate will find it well worth while to have the opportunity of visiting Phoenix under such delightful circumstances.

The rates at the San Marcos will be $10 per day, which will include all meals.

APACHE TRAIL TRIP

A real feature of the Arizona meeting will be a delightful trip provided by the Arizona mining men as hosts, which will convey the delegates over the famous Apache Trail from Phoenix to Globe and Miami. Luncheon will be served at one of the construction camps at one of the irrigation dams now under construction, and an interesting presentation will be made describing the project by G. C. Cragin, General Manager of the Water Users' Association of the Salt River Valley.

In the evening the Globe mining operators will provide an informal dinner at Globe, Ariz., and the following day an opportunity will be given to all of the delegates to inspect the mining plant, mills and smelters at the Inspiration and Miami mines. Both of these mines handle a large tonnage of low-grade copper ore, and the entire equipment is of the latest and most up-to-date character. This trip will be furnished to all of the delegates attending the Phoenix convention as guests of the Arizona mining men.

LOCAL ARRANGEMENTS

The local arrangements for the Arizona meeting will be directed by W. B. Lohring, secretary of the Arizona chapter of the American Mining Congress, Heard Building, Phoenix, Ariz.

Left—Another view in Phoenix. Right—The Roosevelt Dam which will be visited by the delegates on their trip over the Apache Trail

SAFE PRACTICE IN UNDERGROUND TRANSPORTATION

Accidents On Main Haulage Ways Constitute From 10 To 12 Percent Of Those Occurring Underground—Major Causes For Accidents And Methods For Their Elimination Outlined

By LUCIEN EATON*

MOST of the articles written on the subject of underground transportation have dealt with main-level haulage, and comparatively little has been written in regard to sub-level tramming. As sub-level tramming and hand tramming are decreasing yearly in importance through the use of mechanical methods of moving the ore into the chutes or cars, or through changes to mining methods that allow more movement of ore by gravity, main-level haulage is correspondingly increasing in importance. Furthermore the use of animals as motive-power and of rope-haulage is also on the wane, so that the subject has gradually been narrowed to locomotive haulage.

HAND TRAMMING

In a previous paper I discussed the problem of accidents in underground transportation, and in touching on the subject of hand tramming and sub-level tramming, which may be classed together, as far as accidents are concerned, I take the liberty of quoting from this paper as follows:

"The accidents which occur in this kind of transportation are rather frequent and hard to prevent, but are rarely serious. They consist mostly of strained backs, hernia, minor injuries to hands and arms and occasional injuries to head and feet. Strained backs and hernias cannot be prevented, but contributory causes can be decreased by using roller-bearing cars that are easily dumped. Injuries to hands and arms have various causes. When two men are shoveling into the same car one man sometimes strikes the other with his shovel or with a piece of ore. In loading coarse ore men often get their fingers jammed between a heavy chunk and the top of the car. Two of the commonest kinds of accidents to hands are getting the hand jammed between the side or top of the car and the timber in the drift in heavy ground, especially in going around a corner, or in catching the fingers between the car-body and the truck after dumping.

"Guards on top of the car are effective against contact with timbers or chutes above the cars, but no successful side-guards have, to my knowledge, been devised. Blocks properly placed on the truck four inches or more in front of the rear of the car-body prevent pinching of fingers after dumping. Men also occasionally bump their heads, or slip on the rail, or pull the car over their feet, but these accidents are due to carelessness, and cannot be prevented. Occasional accidents also occur, especially where large cars are used, from men being squeezed between cars or between a car and the side of the drift. These accidents are often serious and sometimes fatal, and, being usually due to carelessness, are very difficult to prevent."

With the exception of the injuries to hands and feet and those received in the act of loading most of the accidents in hand-tramming are likely to occur also when locomotive haulage is used, and the means for their prevention will be discussed under that head.

LOCOMOTIVE HAULAGE

Locomotives for underground use are of four types:

(1) Compressed-air locomotives.
(2) Gasoline locomotives.
(3) Electric trolley locomotives.
(4) Electric storage-battery locomotives.

Compressed-air locomotives have been very successful in many instances, and have some advantages under difficult operating conditions, especially on dirty and wet tracks and adverse grades. Maintenance is high and operating efficiency from a power standpoint is low, and they are not growing in favor. There are relatively few installations in this country.

Gasoline locomotives give off objectionable fumes, which vitiate the atmosphere and are often dangerous. Their maintenance cost is high and they are unreliable in service, except under very favorable conditions.

Electric trolley locomotives are very widely used, especially for long hauls, and their size and speed have been increased enormously in the past few years. The desire for large units to haul long trains at high rates of speed has been responsible for many of the accidents that have occurred. In most cases, and especially in coal mines, the weight of the locomotive determines the size of rail that should be used, and, unless the size of the rail is increased, when a larger locomotive is put in service, derailments are apt to be frequent. I understand that a controller has recently been perfected by which one man is enabled to operate two locomotives in tandem. With such a controller two six-ton locomotives have the same tractive effort as one twelve-ton locomotive, and the danger of derailment through overloading the track is reduced. Furthermore, most of the time used in hauling cars is spent at the terminals, picking up loads and leaving empties, and vice versa, and it seems to me that in many cases the speed of the trains on main hauls

U. S. Bureau of Mines Photos

Illustrating Two Avoidable Dangers—Left, Remaining in Car When Loading at Chutes, and, Right, an Unguarded Trolley Wire.

*Superintendent, Ishpeming District, Cleveland-Cliffs Iron Co.

Paper presented to Hibbing, Minn. Meeting, National Safety Council.

U. S. Bureau of Mines Photos

Examples of Proper Precautions—Left, Inspection of Roof and Reinforcement of Ladders Used With Staging. Right, Guard For Protecting Hands on Sub-Level Tram Car.

could be reduced and safety consequently increased without loss of capacity if better terminal facilities were provided. This idea has been borne out in practice in my own experience, for I have found little difference in capacity between trolley locomotives with a speed of eight miles an hour and storage-battery locomotives with a speed of three and a half miles per hour.

Storage-battery locomotives have increased rapidly in popularity in the past few years, and in many places they have displaced trolley locomotives. Their greater flexibility in operation, and the ease with which they can be moved from one level to another are strong points in their favor, and in timbered drifts that crush badly, where the high cost of maintenance of trolley wires and the danger of fire almost prohibit the use of trolley locomotives, they are in a class by themselves. On account of their lower voltage and slower speed and the absence of a bare trolley-wire they are also safer in operation.

The difficulties that arose from the change from hand-tramming and animal haulage to locomotive haulage, that has occurred in the past ten years, and the use of larger equipment have started a movement for improving and standardizing construction and operation of locomotives, tracks and cars, and the American Mining Congress through its Standardization Division has made available much useful information on these subjects. The recommendations of the Underground Transportation committees, and particularly those of the Coal Mining Branch, are well worth studying, and, if adapted to metal mining and put in practice, would go a long way in reducing the number of accidents that occur in this part of the operation.

Changes in car design and capacity are constantly being made, larger and larger equipment being the rule. End-dump cars were succeeded by gable-bottomed or saddle-back cars, and these in turn are being displaced by solid-bodied cars of the rocker-dump or rotary-dump type. This is an advance from the standpoint of safety, efficiency and economy. There is less spill along the track with fewer derailments and fewer men exposed to danger when cleaning track, speed of dumping is increased, and both maintenance and cost of operation are reduced. There has also been a change to outside journals instead of outside wheels, which is a distinct improvement on account of reduction in the frequency of derailments.

If statistics were compiled, showing the number of accidents and fatalities per thousand men employed in locomotive haulage underground in the Lake Superior District, I think that the accident-rate would be astonishingly large, and would show that this part of the mining operation is one of the most hazardous. This fact has, I think, been largely overlooked on account of the relatively small number of men engaged in this kind of work.

Accidents on main haulage ways constitute from 10 to 12 percent of those occurring underground, and of these about 90 percent happen to men operating trains and 10 percent to men walking through or working in the haulage drifts. In order to start a discussion, I have made a rough classification of the various kinds of haulage accidents and a brief statement of the means used or recommended to prevent them, drawing freely from the information given in the papers on this subject published in the proceedings of this Council in the past four years.

Causes of Accidents

Accidents to men filling cars at chutes are probably the most frequent, especially those caused by pieces of ore or rock falling on hands or arms or rolling over the car onto the feet. The use of finger-chutes in hard ores prevents most of these, and handles properly placed on the backs of the stopper-boards also help. Care in placing the stopper-boards, when the chute is hung up, will do the most good in the soft ore mines.

Accidents of this kind were so frequent at the mine of the New Jersey Zinc Company at Franklin, N. J., that a rule was put into effect there several years ago, forbidding chute men to stand in front of the chute when barring. They are required to stand at one side out of the line of flying chunks. This practice makes harder work for the chute men, but has reduced the number of accidents.

One of the most frequent causes of injury is derailment. Aside from danger of personal injury derailments are expensive both in cost of repairs and in loss of product from delay. Their prevention is therefore worthy of much attention. The first requisite in preventing derailments is to have a good track. The track should be carefully laid with sufficiently heavy rails (40-pound rail for 6-ton locomotives), with angle-bar splices at every joint. Joints should be bonded on trolley installations, and a clearance of half an inch should be left between the ends of the rails at every joint to prevent buckling. Ties should be closely spaced, and tie-plates used on tracks of long life. Special attention should be paid to ballast and drainage, which are too often neglected in our mines. Cast steel or manganese steel frogs with flanges or plate frogs with guard-rails should be always used. In laying switches great care should be used to prevent "bunching," which causes side sway in the train, and all frogs and switches that are to be out of use for six months or more should be taken up. Changes in the size of the rails should be avoided, not only because

of the bump that is given where the change in size occurs, but also because wheels that have been grooved through wear on a narrow rail will jump easily off a wider one. Tracks should be kept clean, and timber and other material should not be allowed to lie along the drift.

Next in importance to the track is the condition of the rolling-stock. Wheels on both cars and locomotives should be frequently inspected, and grooved, flat, badly worn or wobbly wheels should be replaced. Outside journals with free-running axles are to be preferred to tight axles and loose outside wheels. The wheel-base should be at least one-third of the length of the car, and should be greater than the track-gauge. On heavy cars springs between the axle and the truck help to prevent derailments from small obstructions on the track, and reduce the danger of broken axles, but often increase body-sway. Couplers should be so designed that cars ride smoothly without crowding when being pushed around a curve. Leaky doors should be avoided, and, if rocker-dump cars are used, their catches should be so designed that they cannot be jounced out of place, while the train is in motion, and allow the car-body to overturn. Locomotives should have a clearance of at least 3½ inches above the rail, and should have wheels and wheel-base suitable for the shortest radius curve that they have to go around. Sharp curves should be avoided, especially on main line tracks. A jack and a set of re-railers should be provided for every locomotive.

Collisions with other trains can be avoided by proper routing and by the use of block signals. When more than one locomotive is in operation on one level, and trains are hauled back and forth through a cross-cut between the vein and the shaft, a block-signal should be used at the end of this cross-cut. This is usually a switch that is thrown by the trolley-wheel in passing, and shows a red light when the cross-cut is occupied and a green one when it is clear. The same signal should be used in other sections of the mine where more than one locomotive is being used.

U. S. Bureau of Mines Photos

Dangerous Riding With Tools Or Riding On An Open Cage

Collisions with ventilation doors often occur, and sometimes inflict serious injuries. Automatic doors that are opened by the weight of the wheels on the track are not efficient on the higher-pressure air-currents, and mechanically operated doors opened by compressed-air or hydraulic cylinders and closed by counter-weights give better service. Every door of this kind should be equipped with automatic switches, which will show a green light when the door is fully opened and a red light at all other times.

On all tracks leading to the shaft, where there is a chance for the locomotive or a car to go into the shaft, a spring-derailing switch that will have to be held open by hand to permit passage should be provided. Collisions and accidents of all kinds are less likely to occur if all haulage-ways are thoroughly lighted.

Automatic couplers should be used on all cars that are hauled in trains. The standard half-size coupler made by the American Steel Foundries is very satisfactory. It is six inches deep at the end, and used to be constructed with a six-inch jaw. When so constructed cars sometimes become uncoupled by one coupler riding over the other when passing over a bump in the track, but the jaw has recently been deepened to nine inches, and such accidents are now almost impossible. Coupler-shanks should be long enough to keep the corners of the cars from coming together on a curve, and the couplers should be protected from falling dirt that may get into the mechanism. Accidents often happen to brakemen who insist on holding the locking-pin in their hands when coupling cars, but such accidents are entirely unnecessary, because the couplers work automatically when properly opened. Couplers should be inspected frequently, and when worn should be promptly changed and the worn coupler sent to the shop for repair. This system gives better results than putting in new parts on an old coupler underground. Most repairs are easily made in the blacksmith shop, and the couplers have a long life.

Most material moved by the train should be carried on special trucks or in the cars. It is bad practice to carry loose material on top of the cars, and there is often danger of striking the trolley-wire in lifting something out of a car. Dynamite should have its special car with an enclosed insulated body, and timber should be carried on timber-trucks. It is often convenient to carry drill-steel, tools, etc., in small quantities on the locomotive, and this is very hard to prevent unless the top of the locomotive is arched or rounded so that nothing will stay on it. A better practice perhaps is to provide a strong cover and side-stakes along the sides so that a small amount of material can be carried without danger of its falling off.

There is always danger of coming in contact with charged electric wires. Storage-battery locomotives have the advantage here, as their voltage is usually about eighty, and they have no trolley wire. There is, however, danger of burns from ignition of gas when the battery is charging, and of acid-burns when lead batteries are used. Battery trays should be insulated from the boxes. In trolley installations the wire should be at least six feet above the track, and should be protected by an inverted wooden trough not over six inches wide inside at all plats and at all chutes. The wiring should be divided into sections of 1,000 to 2,000 feet, and each (*Continued on page* 476)

PRINCIPLES OF MINE SAFETY WORK*

Before Writing "Rules" The Idea Of Safety Must Be Sold To The Men—Progress In Accident Prevention Can Be Secured By Getting The Individual To Think Safety

By F. P. Botsford†

THE idea that safety work was of great enough importance to warrant the creation of Safety Departments by the iron mining companies of Lake Superior was born about 1911 or 1912. As I look back to those days I can see that our first efforts to further the promotion of safety were very crude. We had never given the question much thought; we believed that our mines were as safe as anyone could reasonably expect them to be; we felt that we were taking every precaution to insure the safety of all employes. We see today, after years of thinking and analyzing from a safety standpoint, that many conditions that we believed to be safe then were actually hazardous to a high degree. This clearer vision was not developed by any change in our ideas as to the value of human life, but was brought about by the thinking along safety lines by safety engineers, mine operators, and by the men themselves. The power of thought is unlimited and when a large number of men are thinking on one subject the dark corners become bright. They see more, they see more accurately. Where before we saw the obvious now we see all sides and even beyond the object or condition viewed, and discover the hidden danger which would not have been visible to us if we had depended on our eyesight alone. It is the thinking of many men that is responsible for the great progress in safety work, and our future advancement will depend entirely on how clearly we think.

After the safety departments were created, committees were appointed to discuss the problem of safety and decide on the methods to adopt to make the mines safer. In most cases it was decided that the best method was to formulate what we called safety rules. We worked hard making rules to govern the surface man, the open pit man, and the underground man. The rules were printed in many languages and bound in small books. Every possible dangerous situation was covered by a rule beginning with "Do" or "Don't." It was Do this or that, or Don't do this or that. We were determined to cut out accidents and, like the average American, we thought the best and easiest way was to make a law or a rule against accidents. We even had penalties attached to put teeth in the rules.

We soon discovered that our rules did not reduce accidents any more than sumptuary laws passed by legislatures make the people any better. There is a contrary streak in most of us, and a rule or law that makes no appeal to our reason is apt to make very little impression on us. There are a lot of busy people in this country of ours today who would like to lay down rules of conduct for all of us; they, of course, setting themselves up to be the judges of what is proper for us. I am afraid that the average mine employe, when he received the book of rules in those days, felt that we were going too far with our "Do's and Don't's." Getting injured was a personal matter with him and it was his own business anyway. Further, hadn't he always taken care of himself, and he guessed he could continue to do so without following a lot of Do and Don't handed to him by the boss. Our miners in the pioneer days of safety could not see the need of safety rules and for this reason refused to accept them and abide by them.

When the majority of the people in a state see the need of a law, the law is promptly enacted and it is very easily enforced. When, however, a law is enacted because of the demand from an active minority, as so many thousand statutes have been in our different states, and if the law does not appeal to the majority as being needed, then the law soon becomes inactive. We have a good illustration of this in the so-called Blue Laws on the statute books of many states.

Our first efforts were wrong. Before writing our rules we should have sold the idea of safety to the men. We should have stimulated in the men the desire for a few rules to insure safe operations. We attempted to force the idea of safety on the man without taking into consideration his thought, or better, his lack of thought on the subject. We now obtain real results by trying to instil into the individual the germ of the safety idea which, if properly nourished, leads the man to think about safety. All of us are inclined to resist the didactic Do or Don't on any proposition. We learn only by the development of ideas within ourselves.

We can guard thoroughly each piece of equipment, fence off all dangerous places. We can make rules covering every conceivable hazard, and accidents will continue to occur with distressing regularity. I thoroughly believe that progress in the prevention of accidents can only be made by getting the individual to think safety. If I had to choose between having a mine well guarded but manned with a crew that was indifferent to safety, or having a mine entirely unguarded but operated with a crew who were thinking safety, I would choose the latter, because in my opinion there would be less accidents among the men who were thinking safety. I believe, therefore, the future progress of safety work, the further reduction of disability days, can only be accomplished by sowing the seed of the safety idea in the individual carefully nurturing the seed until its has sprouted into a strong, healthy demand within him for a desire always to work and play in a safe way.

I cannot speak too highly of the interest in safety work and the initiative displayed by the men who are responsible for these conferences. A yearly conference like this quickens the interest in safety work, it is productive of new ideas, and I think we can truthfully say that each meeting advances the work a little further towards the goal you are striving for, the entire elimination of accidents in the mines.

The work the safety engineer is doing is very important because it deals with the welfare of all the men connected with the industry. The more clearly you think, the more energy you display, means more lives saved and the gradual reduction of pain and suffering.

* Paper presented before National Safety Council, Hibbing, Minn.

† District Manager, Pickands, Mather & Co.

TO EDUCATE WORKERS

THE appointment of L. R. Alderman of Portland, Oreg., a prominent educator, as Specialist in Adult Education in the Bureau of Education of the Interior Department has been announced.

The position is a new one created by Congress at its last session because of public agitation that has swept the country for adult education since the World War. The discovery of widespread illiteracy as a result of the draft during the war in which it was found that nearly one-fourth of the men brought into the service were illiterate so far as being able to read intelligently prompted Congress to take action providing for this new post in the Bureau of Education. This specialist's duties comprise problems of illiteracy, immigrant education, home education, factory education, and prison education cooperating with the university extension departments of the various states.

METAL MINE ACCIDENTS—LAKE SUPERIOR DISTRICT

Mine Accidents In Lake Superior District From 1911 to 1923 Were Seventeen Percent Less Than Metal Mine Rate And Twenty-three Percent Less Than Rate For Coal Mines For Same Period

By WILLIAM CONIBEAR†

IN 1911 a number of Lake Superior mine operators decided that in order to reduce accidents it was essential to provide safer working conditions and that employes should be shown that their safety was a prime and fundamental consideration. With this object in view, safety departments were organized and campaigns for the reduction of accidents were inaugurated. Interest in this phase of mining has increased since 1911, and today practically all operators, recognizing their responsibility for the prevention of injuries and accidental deaths, are concentrating their best effort on plans for the elimination of the hazards of the industry. No longer is the economic phase of mining regarded as paramount. Equal in importance has become the slogan "Safety First."

Holmes Mine, Cleveland Cliffs Iron Company, Ishpeming, Mich.

Accident statistics for the entire Lake Superior mining district, prior to 1911, are not available, and we cannot therefore accurately gauge the measure of success that has been obtained in recent years in accident prevention. We know that the industry, from its early stage until 1911, sustained many fatalities annually and that the average annual rate for the entire period was too high to compare favorably with the low rates that were maintained by the metal and coal mines of European countries. I have, however, the figures for the iron mines in Michigan covering the ten years from 1901 to 1910, when 152,430 men were employed and 716 men were killed, which resulted in an average fatality rate of 4.69 per thousand men. I do not think that this rate is too high to be representative of all the Lake Superior mines for that period. For instance, in support of this supposition, the mines of St. Louis County, Minn., for the three years from 1906 to 1908 employed 41,686 men and lost 231 men by accidents, which gave a fatality of 5.54 per thousand men.

The mines of the Lake Superior district from 1911 to 1923, inclusive, employed 563,134 men and reported 1,742 men killed. The fatality rate therefore was 3.09 per thousand. This is 17 percent less than the rate for the metal mines and 23 percent less than the rate for the coal mines in the United States, as reported for the same period. If the average fatality rate, which occurred at the iron mines of Michigan from 1901 to 1910, had prevailed throughout the entire district from 1911 to 1923, we would have sustained an additional loss of 899 men.

The value of this conservation of life cannot be measured in dollars and cents—it is inestimable. It is this evidence, however, that proves that accident prevention is possible. While it is a slow process, we may reasonably expect that our record in the future will be better than that of the past. The fatality record that has characterized the mines of Dickinson County, Mich., since 1900, justifies this expectancy. An average annual fatality rate of 2.63 per thousand from 1901 to 1911 was reduced to 1.65 from 1912 to 1924. If all the iron and copper mines of Lake Superior had had an equally low rate since 1911, 805 lives would have been conserved, in addition to the number that was actually recorded as saved from accidental death. As our fatality rate is now annually higher than that which prevailed in Dickinson County twenty-four years ago, we have no other conclusion to draw than that a lower accident record is possible. Nine hundred and twenty-nine lives compared to 2,621 lives are the figures that may be used to estimate the minimum and maximum liability in loss of life represented by the operation of our mines from 1911 to 1923. In other words, a loss of 70 men annually compared to a loss of 200 men is a possible reduction in the number of mine fatalities if we believe sincerely in accident prevention and work efficiently and consistently to promote higher standards of safety.

I have divided the time from 1911 to 1923, inclusive, into two periods, and have compared them to show the progress made in recent years in reducing accidents. Figures for 1924 are not yet available.

Table IV gives in parallel columns the death rate per thousand men employed underground, open pit and surface, or surface, for the iron and copper mines of this district. I shall not review these rates in detail but invite attention to those that are of particular interest.

The average fatality rate for all mines of the district during the second period (1917-1923) was 15½ percent less than the rate for the first period (1911-1916), based on the number of men employed. All metal mines in the United States show a reduction of 12 2/3 percent. Underground mining in Minnesota and the open pit and surface operations of the iron mines in Michigan had higher rates in the second period, but all other rates show a downward trend. The average rates for the iron and copper mines in Michigan and the iron mines in Minnesota were very close, being 2.82, 2.84 and 2.85 respectively. As these mines extend over a large area and employ annually thousands of men, the similarity of the average fatality rates for the seven years indicates that there has been a united effort on the part of all operators to reduce accidents. The iron mines in Wisconsin sustained no fatalities by surface work during the second period, and a fatality rate of 2.77 for underground was thereby reduced to an average rate of 2.07, the lowest record for both periods. The rates for underground at the iron and

* Paper presented to Hibbing, Minn., Meeting, National Safety Council.

† Safety Inspector, The Cleveland-Cliffs Iron Co., Ishpeming, Mich.

ACCIDENT STATISTICS, LAKE SUPERIOR MINES, 1911-1923 (INCLUSIVE)

TABLE I
NUMBER OF MEN EMPLOYED

	Minnesota (Iron)			Wisconsin (Iron)			Michigan (Iron)			Michigan (Copper)		
	Underground	Open Pit and Surface	Total	Underground	Open Pit and Surface	Total	Underground	Open Pit and Surface	Total	Underground	Surface	Total
1911-1916	49,206	54,730	103,936	7,091	2,781	9,872	64,007	27,633	91,640	60,445	24,447	84,892
1917-1923	40,868	63,059	103,927	5,038	1,707	6,745	65,240	31,772	97,102	42,813	22,297	65,110
Total			207,863			16,617			188,652			150,002
Total for all mines												563,134

TABLE II
NUMBER OF MEN KILLED

	Minnesota (Iron)			Wisconsin (Iron)			Michigan (Iron)			Michigan (Copper)		
	Underground	Open Pit and Surface	Total	Underground	Open Pit and Surface	Total	Underground	Open Pit and Surface	Total	Underground	Surface	Total
1911-1916	166	144	310	25	3	28	303	32	335	279	20	299
1917-1923	144	153	297	14	0	14	236	38	274	173	12	185
Total			607			42			609			484
Total for all mines												1,742

TABLE IV
COMPARATIVE FATALITY RATES PER 1,000 MEN EMPLOYED

	Minnesota (Iron)			Wisconsin (Iron)			Michigan (Iron)			Michigan (Copper)				
Average Fatality Rate	Underground	Open Pit and Surface	All Men	Underground	Open Pit and Surface	All Men	Underground	Open Pit and Surface	All Men	Underground	Surface	All Men	United States Metal Mines	United States Coal Mines
1911-1916	3.37	2.63	2.98	3.52	1.07	2.82	4.73	1.15	3.65	4.61	.81	3.40	3.95	3.89
1917-1923	3.52	2.42	2.85	2.77	0.00	2.07	3.61	1.19	2.82	4.04	.53	2.84	3.54	4.20
1911-1923	3.44	2.52	2.92	3.21	.66	2.52	4.17	1.04	3.22	4.38	.68	3.22	3.75	4.03

Average fatality rate for all Lake Superior mines, 1911-1923....3.09.

TABLE III
NUMBER OF MEN INJURED*

	Minnesota (Iron)	Michigan (Iron and Copper)
1911-1916	27,082	44,379
1917-1923	19,297	36,091
Total	46,379	80,470

* Information for Wisconsin mines not available.

TABLE V
COMPARATIVE INJURY RATE PER 1,000 MEN EMPLOYED

	Minnesota (Iron)	Michigan (Iron & Copper)	U. S. Metal Mines
1911-1916	260	258	208
1917-1923	185	223	247
1911-1923	223	240	227

TABLE VI
STATISTICS, DICKINSON COUNTY, MICH.

	Number of Men Employed	Number of Men Killed	Fatality Rate Per 1,000 Men Employed
1901-1911	31,836	84	2.63
1912-1924	27,189	45	1.65
1901-1924	59,025	129	2.18

copper mines of Michigan were the highest both periods, but the reductions that were made the second period, together with low surface rates due to the employment of many men at less hazardous work, gave average rates that were on a par with the rate established by the Minnesota mines for the entire period.

I stated at one of our Safety Conferences that underground mining was more dangerous than open pit mining, and a number of the delegates from Minnesota took exception to the statement. But if accident statistics are a criterion of the hazards of an industry, they point to this conclusion. In the deep iron mines of Michigan, there are more difficulties to combat in accident prevention than are to be found in the shallow mines of Minnesota, and for the same reason, the deeper mines of the Copper Country are more hazardous than Michigan's iron mines. A review of the principal causes of accidents substantiates these deductions.

Falls of ground, shaft work, cars and steam shovels, and explosives were charged with 75 percent of the fatalities that occurred from 1919 to 1923 at the metal mines in Michigan. The same causes, in different ratios, accounted for 67 percent of Minnesota's total. Fatalities by falls of ground were 10 percent higher in Michigan than in Minnesota and shaft accidents 13 percent higher. On the other hand, the rate for cars and steam shovels in Minnesota was 16 percent higher than the rate in Michigan, which indicates one of the main causes of accidents in open pit mining. The rates for explosives are about the same, approximately 7 percent in Michigan and 6 percent in Minnesota.

Tables III and V give the statistics of injuries that I have been able to collect. The average annual rate for the metal mines of Michigan and Minnesota since 1911 was 232 injuries per thousand men. This is slightly higher than the average rate for all the United States metal mines. Minnesota mines had a reduction of 30 percent the second period in the number of injuries reported, whereas the iron and copper mines of Michigan had a reduction of only 13 percent.

The number of injuries that are being reported every year are many and should command the same serious consideration that is being given to the fatalities. Often the margin between a slight or serious injury or a fatality, is so narrow that we are forced to admit that chance plays no inconsiderable part in the fate of man, but frequent repetitions of accidents by like causes are signs pointing to the hazards that must be studied if we are to be more successful in preventing accidents.

The economic loss that is involved annually by men being killed and injured is large and should be another incentive for promoting accident prevention work. If as many men were injured per thousand men employed in Wisconsin as were injured at the mines in Michigan and Minnesota a total of 10,064 men were injured annually at all mines from 1911 to 1923. The number killed average 130. Mr. W. W. Adams, chief statistician for the U. S. Bureau of Mines, reported recently that three-fourths of the injured workers at metal mines were between 20 and 45 years of age and that the average lost time in each temporary injury was 12.2 days. Assuming as a basis that the average age of men killed was 40 years, that each death represents an average loss in life expectancy of 20 years, and that the average daily wage of Lake Superior mine workers is $5.00, the following computation is made.

Number of days' labor lost annually because of injuries	122,000
Amount of wages lost annually because of injuries...	$610,000
Number of days' labor lost because of each fatality...	6,000
Number of days' labor lost because of 130 fatalities...	780,000

Amount of the wage loss occasioned by one year's fatalities	$3,900,000
Total wage loss occasioned by all accidents for each year.	$4,500,000

This is an economic loss sustained by the commonwealths of Michigan, Minnesota and Wisconsin. There is also an economic burden placed upon the employment where these accidents occur. Compensation payments for a year's accidents have been computed as follows:

Michigan

84 Fatalities at $4,000	$336,000
6267 Injuries at $40.00	250,000
	$586,000

Minnesota

46 Fatalities at $6,000	$276,000
3573 Injuries at $40.00	142,000
	$418,000

Wisconsin

3 Fatalities at $5,000	$15,000
300 Injuries at $40.00	12,000
	$27,000

Total Loss

Michigan	$586,000
Minnesota	418,000
Wisconsin	27,000
	$1,031,000

Michigan and Minnesota have always been in the lead among the metal mining states of the Union in the number of men employed in metal mining. Michigan first, Minnesota second, followed closely by Arizona and Montana. Total days' labor performed, in round numbers, from 1911 to 1923, were 95,000,000 in Michigan; 60,000,000 in Minnesota; 60,000,000 in Arizona and 52,000,000 in Montana. The severe depression that has been experienced the past few years in the Copper Country has reduced very heavily the number of men employed there, but both Michigan and Minnesota will continue to employ for a long time many men in the mining industry.

From statistical data submitted I draw the following conclusion; Accident prevention is not only possible but it is absolutely necessary. Investigation, education and invention are the factors that must be brought into force to stimulate and promote this most worthy work.

SAFE PRACTICE IN UNDERGROUND TRANSPORTATION

(*Continued from page* 472)

section provided with a knife-switch in a box that can be locked with the switch either open or shut. By this arrangement an electrician working on a dead section can be sure that no one will turn the current on while he is working.

The voltage most often used on trolley circuits is 240 to 250 volts at the locomotive, with 250 to 275 volts at the generator. A voltage greater than 300 at the generator should not be permitted.

When a locomotive is not in use, if it is a trolley locomotive, the trolley pole should always be removed from the wire, and in any case the main switch should be opened. Accidents have occurred from neglect of these precautions by the starting of the locomotive when the current was turned on.

The most frequent and usually the most serious injuries to men who are working in the haulage drift or walking through it are caused by their being struck by a moving train. The two best ways to prevent this kind of accident are to have the drift well lighted and to provide a good pathway along the side with sufficient clearance for the train to pass safely. This can easily be done in 8 by 8 drifts in rock, if the track is laid a little off center. If this is not possible, "refuges" should be provided every 300 feet (the Oliver Iron Mining Company places them at 100-foot intervals), the drift being widened at these points enough to accommodate several men. These places should be marked by green lights or by being white-washed, and should be kept clear of rubbish at all times.

All locomotives are provided with headlights, but most of them have grids over the lenses, which catch dirt and prevent proper cleaning of the lens. Lenses of the bulls-eye type are to be preferred. Every locomotive should also be provided with a warning signal—either a bell or a horn. I do not favor automatic horns or bells that sound all the time the locomotive is in motion, as the men soon become used to the noise, and do not pay as much attention to it as they would to an intermittent signal.

When trains are pushed ahead of the locomotive there should be a tail-light on the rear end to serve as a warning to men in the drift. Various kinds are in use, but the most satisfactory in my experience is a large carbide lamp with a red reflector. This is better than a lamp with a red lens, because it is almost impossible to keep the lenses from breaking. The tail-light should also be used when the locomotive is ahead, not only to prevent a rear-end collision, but also to give the brakeman assurance at the end of the trip that he has not lost any cars on the way.

Serious and fatal accidents to men walking beside the track have occurred from trains breaking in two. After the first part of the train had passed, the men stepped out on the track, and were struck by the moving cars that had broken away. Longer jaws on the automatic couplers have practically eliminated this danger. A man is sometimes injured when carrying tools on his shoulder by having them come in contact with the trolley wire. Such accidents usually occur to new hands, who are not familiar with trolley installations, and are rare at mines where the labor turnover is small. The practice of carrying tools on the shoulder in drifts where there are trolley wires should be prohibited.

The suggestions made above for prevention of accidents, will, if followed out, reduce the number of injuries to employes, but the greatest improvement in conditions can be brought about only by constant effort in educating the men to the end that they will themselves appreciate and guard against the dangers of their occupation.

In closing I wish to make acknowledgment to Messrs. B. W. Shove, H. L. Reese, C. D. Woodward, G. F. MacWilliams, A. F. Brosky, A. J. Hoskin, G. M. Gillette and J. W. Reed and to the Standardization Division of the American Mining Congress for information and suggestions taken from their articles.

Lake Angeline Basin, Ishpeming, Mich., From Which 24,000,000 Tons of Iron Ore Were Mined. This is Now Slowly Filling With Water

INTERNATIONAL FIRST AID AND MINE RESCUE CONTEST

Fifty-five First Aid Teams And Eleven Mine Rescue Teams Participate In Contests At Highly Successful Meeting

THE International First Aid and Mine Rescue Contest held at Springfield, Ill., September 10-12, marked a gratifying advance in the great Safety First movement of the mining industry. Sponsored by the U. S. Bureau of Mines, the cooperation of the National Safety Council, the American Red Cross, the Illinois Department of Mines and Minerals, the Illinois Coal Operators' Association, the Central Coal Operators' Association, the Fifth-and-Ninth District Coal Operators' Association, the Springfield Chamber of Commerce, and the United Mine Workers of America, brought together the largest and most representative group ever assembled in this cause.

These contests are open to all miners, quarrymen, and workers in metallurgical plants and in the petroleum and natural gas industries, and are held annually.

Contests for international championships in first aid and mine rescue methods are conducted, and various cups, medals and prizes are awarded to the winners. A Congressional medal is given annually to the team of miners adjudged to be most thoroughly skilled in first aid and mine rescue practice. Another interesting feature of the contest is the bestowal of the medals offered annually by the Joseph A. Holmes Safety Association in commemoration of notable deeds of heroism performed by miners in succoring their comrades in time of peril or disaster.

Local arrangements were in charge of Hon. A. D. Lewis, Director of the Department of Mines and Minerals of Illinois. The U. S. Bureau of Mines was represented by Dr. Thos. T. Read, of Washington, and D. J. Parker, chief engineer of Mine Safety Service, of Pittsburgh, Pa. Hon. William B. Wilson, former U. S. Secretary of Labor, represented President John L. Lewis, of the United Mine Workers, and Dr. Ralph Kaysen, of Milwaukee, the American Red Cross.

In response to the invitation of Secretary Hoover of the Department of Commerce, the Governors of 15 mining states designated the Chief Mine Inspectors of those states to represent them.

Governor Len Small, of Illinois, unable to be present in person, sent a message of welcome, which was read by William D. Ryan, of Kansas City, Safety Commissioner of the U. S. Bureau of Mines.

The first day was devoted to registration, testing of mine rescue apparatus, and examination of crews. In the evening, the Chapter Representatives of the Joseph A. Holmes Safety Association met to discuss the problems involved in organizing additional state councils, and the national council. After discussion, Dr. Thos. T. Read, and Messrs. J. J. Forbes and Wm. D. Ryan were appointed to serve as a committee to organize a Provisional National Council through correspondence with the gubernatorial representatives.

Friday morning the assemblage visited Lincoln's Tomb, and listened to an address by Mr. Wilson, who cited Washington, Hamilton, Monroe, Jackson, Lincoln and Grant, as Americans who arose to meet national emergencies; and predicted that whatever the problem, American citizenship would produce men capable of solving it. A wreath was placed on the tomb by Mr. Wilson, and the pilgrimage returned to the arsenal, where the afternoon was devoted to further contests in first aid.

The judges were a group of 66 Sangamon County physicians, headed by Dr. Walter G. Bain, president of the Sangamon County Medical Society, and 37 laymen, headed by A. L. Assig, representing the coal producers of the Republic of Mexico.

Mayor Bullard of Springfield expressed his interest in the contests and urged the residents of the city to visit the Arsenal while the work was going on. He suggested that the police, ambulance and fire department of the city should be provided with first aid paraphernalia and crews trained in rescue work along the same lines as those being demonstrated by the visiting teams.

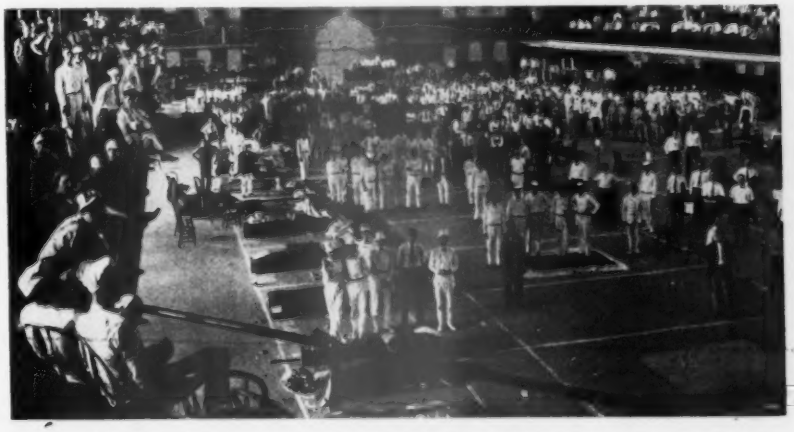
The great floor of the arsenal was chalked off into numbered divisions to which the various teams were assigned. Each first aid team consisted of six men, one patient and five operators. The Boy Scouts of Springfield were assigned among the various teams for aid and observation. Two Federal mine rescue cars were on exhibition at the Illinois Central Railroad Yards.

Friday evening was devoted by the mine inspector delegates to a discussion of problems incident to their work, and Messrs. Read and Parker outlined the course of training given under the Bureau of Mines' course.

On Saturday morning the mine rescue teams began their competition in a special gallery constructed for the purpose and filled with smoke and formaldehyde. There were entered in all, 55 first aid teams from 15 states, and 11 mine rescue teams from three states. Three hundred and fifty team members registered, and over 650 visiting delegates, gubernatorial representatives, and coal mine officials, and over 2,000 miners and visitors.

In the evening a banquet was held at Knights of Columbus Hall, at which over 1,000 guests were seated. The mine rescue team and first aid squad of the Southern Coal, Coke and Mining Company, of Belleville, Ill., won the Congressional bronze medal, and highest honors, with an average of 92.5 percent. The first aid championship of the State of Illinois was awarded to the Superior Coal Co., of Gillespie. The second prize, in mine rescue work, was won by another team from the same company.

Entertainment was afforded by numerous singing and dancing features, and addresses by Hon. William B. Wilson, and A. J. Moorshead, president and general manager of (*Continued on page* 497)



General View Inside Arsenal, International First Aid and Mine Rescue Contest, Springfield, Ill.

WELFARE AND SAFETY IN CONNECTION WITH MINING IN UTAH

Gratifying Progress Made In Recent Years—Utah Copper Has Spent $800,000 In Last Five Years In Improving Housing And Recreation Facilities—Tintic Standard Maintains Model Town At Dividend, Utah

By Dr. A. L. Murray*

WELFARE endeavor in connection with both the metal and the coal mines of Utah has shown gratifying progress during recent years, and in most mining towns of the state, both the operators and their employes deserve much credit for the efforts put forth to better the living, working, educational and recreational conditions. Progress has been and is being made, but there are still a few important towns where purer water and better sewage disposal are pressing needs.

In the older metal-mining towns that are incorporated and are independent of the mining properties operating in the vicinity, less opportunity is presented for the companies to exercise efforts looking toward improved welfare conditions than in company towns controlled by the mine operators.

However, even in such towns the companies can do much to better welfare conditions, as shown by the progress in Bingham Canyon during the past several years. The Utah Copper Company has spent $800,000 since 1920, in the erection of modern brick cottages, apartment houses and the Gemmell Memorial Club. The cottages and apartment houses have every convenience to be found in up-to-date city homes. The Gemmell Memorial Club erected and equipped at a cost of $175,000 was provided by the company for the benefit of the Utah Copper employes living in the canyon and has been made the recreational center for the camp. Another improvement is the $100,000 fireproof hotel built by the United States Mine of the United States Mining, Smelting and Refining Co., in the Copperfield section of Bingham Canyon. This hotel will accommodate 105 men exclusive of hotel help and has all the conveniences of a city hotel.

Many of the towns maintained entirely by the companies at both metal and coal properties are models of their kind. Noteworthy among these might be mentioned that at Dividend, Utah, maintained by the Tintic Standard Mining Company. This town, nestled among the hills of the East Tintic mining district, is well laid out and has comfortable, well-constructed houses and boarding houses, an excellent supply of pure mountain water, and is partly sewered.

The modern town of Keetley erected by the Park-Utah Mining Company is one of the most recent additions to the metal-mining towns of Utah. This town with the best modern tendencies was not built as many of the mining camps of the past, following no preconceived plan and of a mushroom or squatter type. It is situated near the main portal to the mine, but far enough away so that the men in leaving their work will have the benefit of a changed environment in going to their homes. The town was laid out and built along plans which will permit of addition and extensions harmonious with the portion already in use. Keetley has well constructed buildings, a good wholesome water supply and an excellent sewage disposal system. In addition to individual cottages the company maintains an excellent boarding house and recreational hall.

Among the coal-mining towns are many that are above the average in housing, water supplies, sewage disposal systems and recreational facilities.

The town of Hiawatha, Utah, maintained by the United States Fuel Co., has been cited by visitors from all parts of the country as one of the most modern and well laid out coal camps for its size to be found anywhere in the United States. There are attractive and well constructed houses, boarding houses, company offices; one of the finest public school buildings and teachers' dormitories in the state, and two churches. The amusement building is exceptionally large and complete in its accommodations. A new departure by this company is the diversion of all profits derived from the bowling alleys, pool tables, dance hall, motion-picture theater and rent of lodge rooms, to community social and welfare purposes. Hiawatha has an excellent supply of pure water from protected mountain springs and a well constructed sewer system drains the town.

A recent very successful venture of the company which is novel to mining towns of the Western part of the United States at least, is the establishment of a dairy farm to supply milk, butter and ice cream to the several camps operated by the United States Fuel Company in Carbon County. This dairy farm is one of the most modern in Utah, with a herd of forty registered Holstein cows, and has excellently constructed, well lighted and sanitary maintained stables and dairy buildings. The equipment includes milking machines, coolers, sterilizers and a refrigerating plant. This dairy farm is not conducted with a view to making a profit, but to supply clean wholesome milk and milk products to the employes approximately at cost.

Standardville, Utah, maintained by the Standard Coal Co., is another coal-mining town which in many respects is far above the average. This town today shows probably better than any mining town in Utah the benefits of laying out and building along preconceived lines.

It is located on a beach in Spring Canyon at a site which was far from ideal for town building, but due to wise planning and the expenditure of considerable money and labor, the company has made a town attractive both in buildings, arrangements, and setting. Grass and shade trees were almost an unknown quantity in the canyon, yet today Standardville boasts of well-kept lawns and a goodly number of shade trees.

Wet Drilling in Metal Mines

A decided step to effect better health conditions in the metal mines of the state has been the installation of wet drilling machines to replace those formerly run dry. Today more than seventy-five percent of the larger metal mines are drilling entirely with wet machines, and better than ninety percent of all machines used underground in the state are of the wet type. All jackhammer drills are wet, all drifting machines are wet and approximately ninety-five percent of the stopers are wet. As fast as dry machines become unserviceable they are being replaced by the wet type machines. During the past two years the replacement of dry machines by wet drills has progressed very satisfactory and it is estimated that the number of wet machines in use at present is more than double those of two years ago.

Along with the installation of wet machines water has been piped to most of the working faces in such quantities so muck piles can be well wetted down before loading.

This marked increase in the use of wet machines has been a very potent means of reducing the hazards of miners' consumption and lead poisoning, and the companies who have made these changes are reaping the benefits of mines more free from dangerous dusts, resulting in

* Surgeon, Bureau of Mines.

their employes experiencing better health and showing greater efficiency, due to the elimination of dust.

SAFETY

Utah since 1919, has been in the very forefront of the mining states in the matter of safety orders covering both metal and coal mining. Utah in its recent additions to the General Coal Mining Safety Orders of Utah, has gone farther than any other coal-mining state, in clothing underground coal operations with the most up-to-the-minute and effective means of protecting the lives of those engaged in that industry.

In Utah the safety orders are generally enforced, and in most instances cordially obeyed. Too much credit can not be given to the mine operators of this state for their interest and cooperation in endeavoring to make the working conditions in their mines safe, but as will be shown later the results obtained are not as yet as satisfactory as could be desired.

Not only is much credit due the operators for their endeavors to better safety conditions in the mines of Utah, but the miners themselves have contributed much effort to the same end. As evidence of the interest exhibited jointly by the operators and their employes the record of men trained in Utah in first-aid and mine rescue work by the United States Bureau of Mines Rescue Car since 1920 is a striking example.

Men Trained and Retrained in First-Aid And Mine Rescue Work in Utah For the Period, July 1, 1920 to June 1, 1925

Original Training: First-Aid, 2,223; Mine Rescue,, 203; Combination, 335.

Retraining: First-Aid, 246; Mine Rescue, 139; Combination, 41; Total, 3,187.

Few states in the country, mainly the large Eastern coal-mining states, can show a greater number of men trained, and only one Western state, California, due to training in its oil fields, equals Utah.

A STUDY OF MILL BALLS

WITH the purpose of finding a more suitable mill-ball composition, a study of synthetic cast iron is being undertaken by the Bureau of Mines, at its Pittsburgh, Pa., experiment station. In the course of preliminary studies, analyses have been made and Brinell hardness numbers have been taken on a number of cast-iron and chrome-steel balls collected from different points in the Western states.

SILVER REVALUATION PLAN DISAPPROVED

Unpublished Decision Of Treasury Department Understood To Be Against Revaluation—Sixty-five Cent Price Factor Said To Be Upheld

AS this issue of the Journal goes to press it is learned on reliable authority that Internal Revenue Commissioner Blair has decided against a general revaluation of silver mining properties for tax purposes for 1919 and subsequent years.

The decision, which, it is reported, has been approved by the Secretary of the Treasury, holds that there shall be no change in the price of sixty-five cents per ounce for silver which was used in the original determinations of March 1, 1913, as the basis for valuing silver mines.

Where gross errors are found in the determination of cost factors, due to lack of time or data at the time the original valuations were fixed, corrections will be made. It is said that such errors occurred in fourteen typical silver property valuations, and these and other properties which may be found to be in a similar status will be revalued, the price of sixty-five cents per ounce to be used, and the revaluation in each case to be decided by the Commissioner.

This revaluation had been urged by the Couzens committee of the Senate, which investigated the Internal Revenue Bureau, and by engineers of the Bureau. Silver mining interests, aided by the American Mining Congress, protested the revaluation at a hearing July 13 and 14 before Commissioner Blair, Assistant Secretary of the Treasury Moss, and Solicitor Gregg.

The decision in this case will prevent revaluation in forty of the fifty-four cases reopened by the Department.

MECHANICAL LOADING IN COAL MINES

A SURVEY of mechanical loading equipment and methods employed in 65 coal mines in eight states has been completed by the Bureau of Mines, Department of Commerce, in cooperation with the Carnegie Institute of Technology, Pittsburgh, Pa. The purpose of the survey was to study the types of coal loading machines that are in the development stage and those that have been developed to the operating stage, with a view of ascertaining the conditions under which such machines may be employed to economic advantage. Five main types of loading machines, which include 31 varieties, were examined.

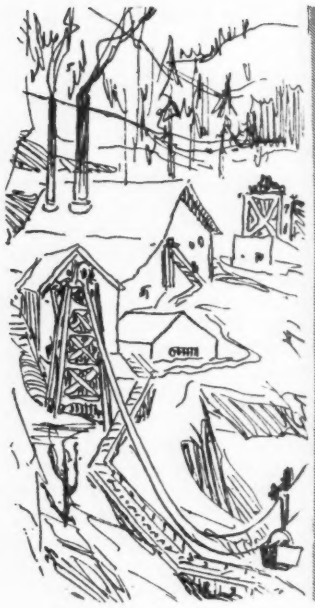
Among the mechanical appliances used in coal mines the loading machine is undoubtedly attracting the most attention at the present time, state F. E. Cash, mining engineer, Bureau of Mines, and E. H. Johnson, Research Fellow, Carnegie Institute of Technology, in Bulletin 17, just issued by the last-named institution. By its use the mine operator expects to and will reduce his cost of handling coal underground. Although there are a number of loaders working satisfactorily, it may be said that the whole problem is in the development stage.

Unless there is a real reduction in cost possible with machine loading the operator can not afford to replace his hand labor with machines. The reduction of the area of a mine under development, a fewer number of working places, a reduction in haulage maintenance, a concentration of supervision, and a more rapid recovery of pillars and stumps, all are factors sure to be reflected in lowered mine costs.

Because of the large number of variables involved, the recommendations that the authors can make as to machine types must be general and not specific. For high, clean coal in nearly level beds the most successful machines are of the mine-car loader type, with track or caterpillar mounting. For beds of medium thickness, level or moderately pitching, which contains waste material that must be cleaned at the face, hand-loaded conveyors are the best. Here may also be included self-loading conveyors where the coal is clean or is cleaned at the tipple. The field of scraper loaders thus far lies chiefly in thin or steeply pitching beds, under which conditions it is unequalled in clean coal. Where coal in such beds requires cleaning at the face, shaker conveyors and others of the drag-flight and traveling apron types are indicated. The various entry-drivers have definite capabilities as earners, and usually will function best as adjuncts to other types of loading machines.

The prospective user of loading machines can do no better than submit his problem to the manufacturers of the type of machines that he considers suited to his needs, and the field engineers of these companies will give him real service in analyzing his loading problems.

Copies of Bulletin 17, "Mechanical Loading in Coal Mines," may be obtained from the Carnegie Institute of Technology, Pittsburgh, Pa., at a price of $1.00 per copy.



METALS

PRACTICAL OPERATING MEN'S DEPARTMENT

Practical Operating Problems of the Metal Mining Industry

THE PURPOSE OF THE PRACTICAL OPERATING DEPARTMENT

Department For Discussion Of Practical Operating Problems Of Metal Industry Is Installed—Its Purpose Outlined

By GUY N. BJORGE*

THE aim of the special department devoted to operating problems which makes its initial appearance in this issue of THE MINING CONGRESS JOURNAL will be to carry a series of articles and discussions on the daily problems of the mine operator. These will include such problems as organization and personnel, methods in all branches of metal mining and the reduction of ores, the machinery and equipment for various work—in fact all problems that will be of direct interest to operating officials. It will, then, supply the metal mining industry the same service in the field of operating that the Journal has heretofore supplied in the economic and legislative field.

When fully under way this section of the Journal will be devoted to one general subject in each issue with discussion of the various phases of that subject from differing points of view. Articles submitted need not be of great length nor too highly technical. This section will, then, be an open forum in which good practice and bad practice may be openly and frankly discussed with comparatively short contributions from as many men as possible.

This department will welcome the discussion of methods or equipment that have not given satisfactory results. Methods of machines that are tried out with unsatisfactory results are not often described in the technical press. And yet, the experience gained in such cases may be of direct value to other operators who may thus be saved the cost of making the same attempt. Or, perhaps, another operator with somewhat different conditions or with some modification of the method described, may develop it successfully. In other words, it is well to know the limitations as well as the advantages of a machine or method.

The first of these articles appear in this issue with the papers by H. H. Pratt, on Generating and Utilization of Power in Copper Mining, and Underground Caving Methods by J. P. Hodgson.

The Journal invites and urges an active discussion of all articles that may be published in this section. For, a live discussion, especially where there is difference of opinion, inevitably brings out the best information available regarding the subject discussed.

The following are some of the subjects selected for discussion in early issues of the Journal:

1. Handling of Materials, Including Ore, Waste and Supplies in Underground Mining.—This will be the subject for discussion at the session to be devoted to operating problems at the meeting of the Western division of The American Mining Congress, to be held at Chandler, Arizona, during the week of November 16. Papers secured for that session assure an interesting and instructive discussion.

2. Recent Progress in Milling with Especial Reference to the Development of Selective Flotation.—Selective flotation in the separation of pyrite and chalcopyrite and in the treatment of complex lead, zinc, silver ores is probably the most important recent step in milling practice.

3. Contrast of Exploration by Drilling and by Underground Methods both in the Development of Prospects and in Exploratory Work in Operating Mines.—This should bring out the advantages and disadvantages of each method, the types of deposits to which each is applicable, the reliability of results, and the comparative costs.

4. Mechanical Loading in Metal Mines.—With a discussion of the mechanical loaders now in use, their value and limitations.

5. Recent Progress in Leaching—Including the leaching of tailings and the leaching ofore bodies in place and the developments in the leaching of mixed and complex ores.

6. Underground Haulage.—When and where to use (a) compressed air haulage; (b) trolley wire haulage; (c) storage battery haulage; and the advantages and disadvantages of each.

* Consulting Engineer, San Francisco, Calif.

THE GENERATION AND UTILIZATION OF POWER IN COPPER MINING

Much Attention Is Given To Obtaining Maximum Efficiency And Low Cost In Generating Electric Power—Large Losses May Be Avoided By Use Of Proper Equipment And Distribution—Developments In Power Station Equipment Outlined.

By H. H. PRATT*

AS a preface to this subject, a brief history of the development of power in copper mining may be of interest.

Twenty-five years ago the power used was almost entirely steam, and each mine shaft was equipped with a boiler plant using wood or coal and later oil as fuel, which supplied steam for the hoist, pumps and air compressor. The electric power plant usually consisted of either Corliss engines or, in some cases, Crossley gas engines belted to direct current generators furnishing lights and power to some small motors, while the underground haulage was handled almost exclusively by that faithful friend, the mule.

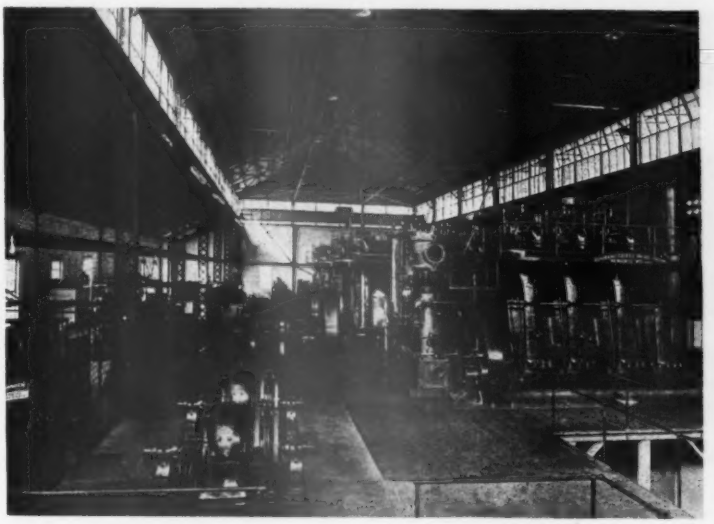
With the introduction of alternating current generators, both hydraulic and steam turbine driven, the modern water-tube boiler and cheap fuel oil from California, the progress of electrification of the copper mines was fairly rapid. The central power station replaced the scattered steam plants, and the steam driven hoists, pumps and air compressors were replaced or remodeled for electric motor drive. The mule gradually gave way to the electric locomotive for underground haulage, and to a great extent the small steam locomotive was replaced by the electric for short surface haulage.

Today the power required in copper mining is generated and distributed in two forms; i. e., electric power and compressed air. Taking these separately in the order named, we will first consider—

ELECTRIC POWER

In some parts of this country, especially the North and Northwest, there is available cheap hydro-electric power, and many of the mining companies do not have the problem of generating their power, but the problem of utilizing this purchased power to the best advantage involves considerable engineering ability, together with cooperation on the part of the operating staff, as most of this power is purchased on what is called the "peak load" basis, which means that in order to get the lowest total cost for the power used it is necessary to maintain a load factor or average load which will be a high percentage of the maximum peaks.

In the Southwest nearly every mining company has to generate power by the use of fuel, and with the constantly increasing price of fuel during the past few years the efficient generation, distribution and utilization of power have become important factors in the cost of producing copper.



A Diesel Engine Plant of the Phelps-Dodge Corporation

The problem of electric power generation for mining can probably be divided into three general divisions or classes:

First, the small mining plant without mill or smelter, requiring from 250 to 1,000 kilowatt maximum load.

Second, the medium-size plant with mines and mill, requiring from 1,000 to 5,000 kilowatt maximum load.

Third, the large plant with mines, mill, smelter and possibly leaching or other reduction processes requiring over 5,000 kilowatts.

For the first class of plant the most efficient type of modern generating equipment would be the four-stroke cycle type of full Diesel engine direct connected to electric generators with the semi-Diesel engine, the uniflow steam engine and the steam turbine as alternatives in the order named. This statement may be questioned by some power engineers, but it must always be borne in mind that a mining plant of this class will be subject to extreme variations in load and in many cases would have a very light load or none at all for 8 hours or perhaps 16 hours per day, depending on whether operations were on a one, two or three shift basis.

For the second class of plant the choice of generating equipment would be between the two-stroke cycle Diesel engine and the steam turbine, with the price of fuel as the controlling factor in the decision. With low-cost fuel oil or coal the turbine plant would have preference, but with high fuel cost the Diesel engine plant would give the cheaper power cost, and with the present prices for fuel in the Southwest the Diesel plant for this size and character of load shows a substantially lower operating power cost than a turbine plant. The accompanying photograph shows a modern Diesel engine plant for this class consisting of four 1,250 horsepower engines direct connected to 815 kv-a., 6,600-volt generators, also 4,000 cubic feet 100-pound pressure air compressor direct connected to 750 horsepower Diesel engine, and in right foreground, not shown in photograph, an air compressor direct connected to a 6,600-volt synchronous motor.

For the third class of plant there are many factors which would govern a decision as to the type of generating plant to install, but in general, if the problem is not complicated by large power requirements for electrolytic work, the economical generating plant would be a combination of turbine and Diesel engine plant.

Most modern smelters have a large

* Chief Mechanical Engineer, Phelps-Dodge Corporation.

excess of steam, above their own power requirements, generated by the waste heat boilers on the reverberatory furnaces, and the generating plant to obtain the lowest power costs would consist of a turbine plant of sufficient capacity to utilize all this waste heat steam and a Diesel engine plant to carry the balance of the required power load.

In these statements regarding power generating equipment I have based them entirely on operating power costs without attempting to go into the details of investment, interest and depreciation charges, number of generating units in the plant, etc., for the reason that not only these but fuel and labor costs, plant load factor and peak loads must all be considered for the individual plant under consideration.

In selecting the electric generators for a plant, local conditions will largely govern this. The two kinds of alternating current which are almost entirely standardized on are three-phase, 25-cycle, and three-phase, 60-cycle, with generating voltages of 2,300 volts, 6,600 volts and 13,200 volts.

It is now generally considered good policy to adopt the phase and cycles which are used by other plants in the locality, so that in emergencies plants can be interconnected quickly. The generator voltage will depend on the location of the plant with reference to the load. If a large part of the load is within economical transmission distance for one of the standard generator voltages mentioned the proper one should be selected; if, however, a large part of the power is to be transmitted a considerable distance, requiring step-up transformers, and the remainder used fairly near the generating station, 2,300 volts would be the desirable generator voltage.

To obtain the direct current for electric haulage either rotary converters or motor generators are used, and these should be located with reference to the load so as to require the minimum of copper for the direct current feeders. A few years ago it was considered dangerous to run high-voltage cables into the mines, but with the improvements in cable construction and insulation voltages up to 6,600 volts are carried into the mines without trouble, and direct-current substations for mine haulage can be located at convenient points in the mines. Storage-battery locomotives for gathering and light haulage work are becoming more popular in the copper mines, and these require the underground charging stations, usually of the automatic type with motor generator set.

In nearly all the larger copper mining plants a great deal of attention is given to obtaining the maximum efficiency and lowest possible cost in generating electric power, as this shows clearly in the cost sheets, but there are large losses in the distribution and use of this power which could be avoided by the use of the proper equipment and distribution.

The selection of transformers, wiring and motors of the proper size, type and speed is just as important for the overall economy of the plant as the selection of the power plant equipment, and I think a great many managers would be astonished if the figures were given them showing the total power losses from the generating plant to the power delivered by the motors.

In mining work there is far too great a tendency to install mechanical or electrical equipment which is on hand, but not suited to the work, without considering what it will cost in power over the use of suitable equipment.

Passing to the second form of power:

Compressed Air

We will consider only the 80-pound to 100-pound pressure air ordinarily used in mining operations without which the work in a modern mine would be at a standstill.

This air is compressed in two stages with cooling between, and there are three types of air compressor drive in common use; the compound or triple expansion steam engine, the electric motor and the Diesel engine.

The air compressor plant should be located as near the center of distribution as possible, and this factor will often determine the type of drive to be used. Where the compressor capacity is large and the compressors can be located in the plant with the electric power generators the steam engine drive should be used in the steam power plant and the Diesel engine drive in the Diesel power plant. If the compressor capacity is small and electric power cost fairly low the direct connected synchronous motor drive will probably be the most economical. When the compressor plant must be located away from the electric power generating plant the synchronous motor drive is most commonly used, but in many cases with a large capacity plant the Diesel engine drive will prove more economical.

Some years ago in estimating the required compressor capacity for a mining plant it was customary to figure the consumption of the number of air drills to be operated and add a small amount for miscellaneous uses and leakage, but the uses for compressed air around a mining plant have increased to such an extent that the miscellaneous uses often equal or exceed the air used for drills, and the distribution and economical use of air are difficult problems.

For a large capacity plant the balanced pressure storage system is the best, and, in fact, almost a necessity where large hoists are operated on air, and has the advantage of maintaining a fairly constant air pressure at the drills and better economy on the compressors due to steadier speed.

The losses and inefficient uses of air are much harder to check than those of electric power, but with the introduction in recent years of several fairly reliable types of air meters some progress has been made along these lines, and even if accurate measurements are not obtained, in many cases a substantial saving in air consumption can be made by metering the air to a mine or mine division, due to the fact that it stimulates the interest of the mine foreman in trying to reduce the air waste and cut down his air consumption.

STATE ORGANIZATIONS TO COOPERATE

THE California Development Association, the Department of Mines and Mining of the Sacramento Chamber of Commerce, the Mineral and Allied Industries of California, the California Metal and Mineral Producers Association, and the California Chapter of the American Mining Congress are arranging for a series of joint regional conferences this fall throughout California, to formulate a statewide working program for the advancement of the mineral industry.

Problems to be included in the discussions are: (1) Congressional legislation to exempt gold and gold mines from federal income taxation; (2) Congressional legislation to advance funds for the construction of hydraulic debris dams in the Bear, Yuba, American and Consumnes rivers, the nation to be reimbursed from the earnings of the hydraulic mines using these dams; (3) readjustment of mineral land rights, particularly in railroad and sheep grazing grants; (4) status of the new law to prevent high-grading of gold; (5) relief from unjust assessments of mining properties for taxes; (6) financial assistance for the reopening of mines; (7) marketing our commercial deposits of non-metallic minerals; (8) introduction of new industries using mineral products.

Northern and Central California meetings will be as follows: Grass Valley, Tuesday, September 15; Stockton, Friday, October 9; Redding, Tuesday, October 13; Sacramento, October 26. Meetings are now being arranged at San Diego, Los Angeles and either Randsburg or Bakersfield.

Representative industrial leaders of the State will be among the speakers, as well as executives of the State Mining Bureau, U. S. Geological Survey, and the California Debris Commission. All interested in the development of California's vast mineral deposits are urged to attend.

UNDERGROUND MINE CAVING METHODS

An Outline Of Present Trends, Recent Developments And Future Possibilities—The Writer Believes That Such Splendid Results Have Been Obtained That Future Installations May Swing From Steam Shoveling To Caving Methods

By J. P. Hodgson*

IN approaching this subject the writer may be permitted the statement that the nature of his mining experience has, for the most part, been in the practical rather than the technical field, and has covered several methods of mining, comprising most of the systems in use in the Michigan Iron Ore Mines, and the Arizona Copper properties.

Thirty years ago the methods in vogue in the Michigan mines, for the greater part, consisted of Overhead Stoping, Underhand Stoping, and some Shrinkage Stoping in the hard or specular ore mines, to which later was added Horizontal and Inclined Cut and Fill, Rill Stoping, etc., while in the soft hematite mines in the earlier days the room and pillar system, using very heavy timber with waste filling, was much in evidence, which later was largely supplanted by Horizontal Top Slicing, Sub-Level Caving, and in one instance at least by Block Caving, the latter system being used at the Pewabic Mine, Iron Mountain, under the general direction of Mr. E. L. Brown. The ore was laid out in blocks 200 feet by 250 feet, and the vertical height of ore drawn was 100 feet. This method was used there from the year 1893 to about 1920, at which time I believe the property was practically exhausted. However, I am advised the system gave very satisfactory results. There may have been other properties operated by systematically planned caving methods prior to the Pewabic Mine of which I have no knowledge. One thing I do know, and it is that most mine operators can recall in their past experiences, cases of involuntary caving in their mines which they were very anxious to avoid, these usually occurring in heavy ground, and often caused by opening up too much of this type of ground in a given area, or by poor timbering, poor planning, etc. These occurrences were usually very expensive, and embarrassing to the men in charge. Therefore, whenever feasible, why not adopt methods less expensive, and which can be made to give better results, by taking advantage of nature, or gravity.

It is obvious that no rule of thumb can govern mining methods, as conditions vary so greatly, even in mines located in the same district, as to sometimes make comparisons of little or no value.

I believe it will be agreed that some of the fundamental requisites necessary to successful caving operations are: (1) An orebody of a reasonably even grade of ore; (2) an orebody of good vertical height or thickness, and (3) side walls as dense or denser than the orebody itself, and, after it has been decided to adopt a caving method: (1) Careful planning of the development and stope preparatory work to insure maximum tonnages for this preliminary expense; (2) positive control of the "drawing off" of the ore from the stopes, in order to keep dilution by extraneous material at a minimum; (3) an adequate ventilation system to insure good working conditions for the men, and to eliminate smoke, dust, etc., as far as possible; and (4) an economical transportation system for tramming and hoisting, and for handling men and materials.

J. P. Hodgson

I may mention a few notable and successful operations in the West, and Southwest, whose mining operations for the most part, and in some cases entirely so, have been confined to various caving methods of mining. The Ohio Copper property, which for some years used the Branch Raise and Undercutting Method, and which is now in use at the Inspiration Mine, with some modifications; The Ray Caving Method, planned and put into effect by Mr. L. S. Cates, who is this year the President of the American Mining Congress; The Miami Caving Method, developed and used successfully at the Miami Mine for many years; and the Ruth Caving Method, which has proven so successful in an orebody consistently softer than any of the above. I will not attempt a detailed description of these methods, for it is sufficient to say that all of them have their own characteristics, all have been more or less successful, and most of them to such a degree as to deserve emulation by those desiring to initiate some caving method into their mines.

It is my opinion that the present trend in caving methods is to a higher vertical column of ore in stoping operations, thus reducing the preparatory costs and yielding better efficiency in tons per man, and also to better control, of the "drawing off," thus favorably affecting final costs. Many operators seem to feel that in some cases it may be possible to increase the ore column up to the entire vertical height of the orebody, particularly where the ore is low grade. The Miami Copper Company is now preparing an orebody along these lines, and hopes to lower very materially costs that have heretofore obtained. This can best be done where the entire orebody has been fully explored and before mining operations have commenced, but very few companies care to expend the money necessary to obtain all of this information before starting actual mining.

In view of the splendid results obtained by caving methods and the general tendency to increase the height of the ore columns in "drawing off," I would not be surprised to see in future installations a (*Continued on page* 506)

* Manager, Morenci Branch, Phelps-Dodge Corporation.

COAL

PRACTICAL OPERATING MEN'S DEPARTMENT

Practical Operating Problems of the Coal Mining Industries

AUTOMATIC CONTROL OF DIRECT CURRENT CIRCUITS IN COAL MINES

Full Automatic Control Meets All Existing Conditions—Semi-Automatic Control, When Easily Accessible And Operated On Alternating Current Offers Full Protection—Two Or More Stations, With Inter-Connected Direct Current, One Full, And Balance Semi-Automatic, Are Satisfactory

By T. F. McCarthy*

AUTOMATIC equipment for direct current mine circuits may be roughly divided into two general classes: Automatic substations and automatic sectionalizing equipment.

Automatic substations naturally divides itself into a discussion of (a) full automatic and (b) semi-automatic control of motor generators and synchronous converters used in generating direct current for mine service. Both types of control are applicable and their use is determined by individual conditions.

Full automatic control of mine generating equipment is that type of control which performs automatically and in proper sequence all the functions of starting and stopping ordinarily performed by an attendant in a manually operated station and in addition protects the machine from single phase starting and running, against overload and low voltage and hot bearings on the machine and protects against over-speed and under-speed. With this type of control, the machine is started either by means of a remote control push button at any convenient location at any distance from the station, or by a time clock that starts and stops the station at pre-determined intervals, or by means of a contact-making voltmeter that starts and stops the station as voltage conditions require the station to be on or off the line. When there are two or more machines in the same station and one of the machines is controlled by one of the above methods, the second machine is usually controlled by means of a contact-making ammeter that starts it when the capacity of the first machine has been exceeded.

In connection with railway, as well as industrial and mining service, full automatic control has been successfully used for a number of years and is, therefore, beyond the experimental stage and can be relied on for dependable service and has proven successful in its application to both motor generators and synchronous converters. The continued increase in the number of installations of this type of control is an indication that its use has been justified.

The principal reasons for adopting this type of control are as follows:

1. Stations can be located in load centers, either on the surface or underground. If located on the surface they can feed into the D. C. system through a bore hole and the station does not need to be located as to its accessibility from inside the mine. When located inside the mine the A. C. circuit can be brought into the mine through a bore hole cable and the station located with reference to the load and not as to its convenience to certain workmen within the mine.

2. The elimination of attendants.

3. The increased protection of equipment over that secured in a manually controlled station.

Frequently we find a substation is located either at the mine opening or fan shaft at a considerable distance from the load center; the reason for such location being that the fan attendant or other outside man may, in connection with other duties, take care of such manually equipped stations. The fact that increased copper losses and poor voltage regulation, with its resultant increase in maintenance of electrical equipment, may result from the location of the station at a remote distance from the load will offset, and in most cases, be much greater than the supposed saving made by the elimination of station attendants. If substations of comparatively small capacity (of from 150 to 300 K. W.), depending on load conditions, are properly located in load centers and equipped for full automatic control, the result will be—dependable service, good voltage regulation with a minimum investment required for feed lines, minimum line losses, reduced main-

*Superintendent of Equipment, Clearfield Bituminous Coal Corporation, Indiana, Pa.

tenance of electrical equipment, the elimination of attendant charges and equipment adequately, and in every way, fully protected.

The care of full automatic equipment is not difficult. A weekly inspection made by a competent mine electrician is all that is ordinarily required. Such inspection should cover the examination of all contacts, relays, wiring on the switchboard, the brushes and bearings on the machine and the cleaning of equipment and station. The protective devices are also tested during these regular inspections and the inspector should be required to note in a log book, kept at the station, the condition of the equipment when inspected and any adjustments or repairs made. The inspector is thus held responsible for the condition of the equipment which tends to minimize possible interruptions due to faulty operation of relays.

Automatic Switching Equipment, Jeddo Highland Coal Co., Jeddo, Pa.

Frequently coal operators or engineers object to the use of automatic equipment on the grounds that such equipment is too complicated to be properly cared for by the average mine electrician. It will usually be found that any mine electrician, capable of reading a wiring diagram, can readily take care of this equipment. Initial cost frequently prevents the installation and use of automatic equipment but it will usually be found that the increased investment required will be returned in the saving affected by eliminating attendants in from one to two and one-half years; this period of time being dependent upon the wages and the number of shifts required if the station was manually controlled.

The use of semi-automatic control has many advantages. The principal consideration that determines the use of semi-automatic control is first cost. Where a station is so located that it is accessible within a reasonable time, and operated from an A. C. circuit that is not subjected to frequent interruptions and it is thought that the cost of full automatic control is not justified, semi-automatic control can be installed and this installation will operate satisfactorily and will not require attendants.

In this type of control the incoming A.C. circuit is equipped with overload and low voltage relays and phase failure relay. The machine is protected from overspeed and hot bearings and the D. C. end equipped with an automatic reclosing circuit breaker arranged for multiple or stub end circuit. Where the machine is loaded up to capacity a greater part of the time, as an additional protection a thermostatic overload relay should be used on the A. C. incoming circuit to the machine. With this type of control the machine is almost as fully protected as the full automatic control but has the disadvantage of requiring hand starting in case of a shut down.

It will be found that, where two or more stations are feeding into an interconnected D. C. circuit, if one station is equipped for full automatic control and the balance of the stations are equipped for semi-automatic control, a very satisfactory distribution system will be secured. The full automatic station can operate continuously and the semi-automatic station only when the mine is operating.

Direct current sectionalizing equipment is also an important item of control in distribution circuits within the mine. Where more than one station is feeding into an interconnected system, automatic sectionalizing breakers should be installed to sectionalize stations to a particular load center. These sectionalizing breakers allow an underloaded section or station to assist an adjoining section that is overloaded but prevents any heavy overload or short circuit from affecting the adjoining section and confines this unusual condition to a restricted area until cleared up. These breakers can be used to advantage on stub end circuits where a section is subjected to frequent interruptions due to overloads or to sections where frequent short circuits occur due to falling roof that breaks down over head trolley lines. These sections are automatically disconnected until normal conditions are restored.

In full automatic and semi-automatic stations the direct current automatic circuit breaker is called upon to function more often than any other item of control in this type of equipment and the success of automatic control is governed entirely by the correct operation of these breakers. The function of a direct current automatic breaker is to disconnect the trolley circuit from the source of supply when an overload or short circuit occurs and to re-close when the condition of the circuit becomes normal. As this breaker must not re-close when the external circuit is overloaded or short circuited, the breaker must differentiate between a normal load and an overload or short circuit. It is due to the lack of understanding on the part of operating men of the importance that external resistance of the circuit bears on the correct operation of these breakers that has resulted in so many failures. As a concrete example—a 300 K. W. 275 volt generator, with full load rating of 1,034 amperes, is equipped with a direct current automatic reclosing breaker. Under normal mine service the breaker will be set to operate at 150 percent full load current of the generator or about 1,500 amperes. In order that the generator be properly protected, the breaker must not reclose when the resistance of the external circuit is less than that of the circuit when the generator is delivering full load current or .275 ohms and under normal conditions this load on the re-closing of the breaker should not exceed one-half full load value or .55 ohms.

In a mine where it is the practice for motormen or machine cutters to leave their controllers in an "on position" when the breaker operates, and pump motors, blower fans, etc., are connected directly across the line, on the operation of the breaker, the combined resistance of the various motors in multiple reduce the external resistance to such a value that the condition is similar to that of a short circuit in so far as the operation of the breaker is concerned and it will not close, or if it is adjusted to re-close at this value of external resistance the breaker does not protect from overloads or short circuits and the breaker is not considered successful in its operation.

If the application of automatic substation equipment is contemplated, a very thorough study of the external circuit conditions is required and, if necessary, all pump motors, etc., must be equipped with line contactors to entirely disconnect (*Continued on page* 499)

METHOD OF INCREASING LUMP-COAL PRODUCTION, WITH ESPECIAL REFERENCE TO SOUTHERN ILLINOIS

Results Of Illinois Tests Show Nine Items As Fundmental Factors In Breaking Down Coal At Face Which Govern Production Of Lump Coal In Typical Mines Working Different Coal Beds

By J. E. TIFFANY * and J. J. MCKITTERICK †

THE tests by Tiffany and Nelson,‡ in 1923-24, showed that the use of a cartridge of smaller diameter than that used in mine practice resulted in an increase of 5 percent in the amount of lump coal passing over a 1¼-inch bar screen, with a reduction of 32 percent by weight in amount of explosive required. On the other hand, they found that on reducing the weight of charge 20 percent, and using the cartridge of larger diameter, the round would not throw down the coal satisfactorily.

Experiments with "snubbing" showed a similar improvement in quantity of lump coal, and the coal that was blasted rolled forward into the working place. However, in recent tests at another mine where the coal had different physical characteristics, snubbing did not always result in the coal rolling forward, on account of clinging to the ribs, and was not found to be an advantage. Therefore the writers of this paper recommend that tests be made before deciding upon the adoption of snubbing in a particular mine.

The use of an air space in front of the charge was found to increase the quantity of 1¼-inch lump coal. The greatest amount of lump coal obtained in their tests was obtained by a combination of air-spacing and snubbing, by which means there was a 7.4 percent increase in lump coal and a 31 percent decrease in the weight of the explosive charge.

SCOPE OF PRESENT INVESTIGATION

Through an arrangement made by the superintendent of the central district experiment station of the bureau at Urbana, Ill., with a coal company operating mines in southern Illinois, a study of blasting methods was conducted in one of their mines, the results of which form the major part of the information and data here presented. This particular study forms part of the general investigation on lump coal.

In addition to the tests in this mine, some observations were made in three other mines in the same field in order to gather general and comparative information on blasting conditions. All the mines visited were working the No. 6 coal bed of the southern Illinois field. Practically all of the coal mined in this field comes from the No. 6 bed, which underlies most of Jefferson and Franklin Counties and the northern half of Williamson County. About one-third of the coal mined in Illinois (67,000,000 tons in 1924) comes from the mines in Franklin and Williamson Counties.

CHARACTERISTICS OF NO. 6 COAL BED

The coal of No. 6 bed, as worked in the mine investigated, is fairly representative of the coal in the entire field, except as to hardness. In this mine the coal has a thickness of about 8½ feet, but in other parts of the same field it sometimes attains a thickness of 13 to 14 feet. The coal of this mine in the lower 3 feet is relatively hard, but begins to get soft about 3 feet from the floor. At 4 feet up it is still fairly hard, but above this height it is soft. Inspection of the face after blasting indicates that the coal in the soft part of the bed is more or less "tough" and "woody," and of a "punky" nature, and does not have the clean, clear, brittle fracture characterizing other mines in the field. The position of the soft coal above the hard coal, together with the character of this soft coal, causes poor shooting and the production of a high proportion of screenings. Below the coal is a hard gray clay, and above is a gray shale. This shale does not make a good roof, so about 18 inches of coal is left in place as a roof. The coal that is mined separates readily from the roof coal along a parting of mother coal. A parting known as the "blue band," of hard gray shale about 1½ inches thick, is present at a uniform height of 18 inches above the floor.

METHODS OF INVESTIGATION

The first step in the investigation was to observe the methods of shooting at the working faces. As a result of preliminary tests extending over eight weeks, a standard method of drilling and shooting was formulated and put into effect. This was followed later by the introduction of a cartridge of smaller diameter. After these improved methods were fairly well established, the proportion of 6-inch lump coal was increased 2 percent over the average of a previous 10-month period. This result was obtained without any changes in the methods of handling and preparing the coal subsequent to shooting.

MINING METHODS

The mine investigated had an average daily output of 4,000 tons. It is worked on the room-and-pillar, panel system. The entries are 12 feet wide on 40-ft. centers, and the rooms 21 feet wide on 40-ft. centers, but often they were found to vary in width from 20 to occasionally as much as 26 feet. Electric cutting machines were also used and an undercut of 6 or 7 feet was made, depending upon the type of machine used.

BLASTING METHODS

Prior to the present investigation about 90 percent of the coal mined was undercut and blasted with permissible explosives and 10 percent was shot off the solid with black blasting powder. As the investigation proceeded, the amount of coal mined off the solid by blasting with black blasting powder decreased to less than 3½ percent. None but permissible explosives were used in the tests, and the improved placement of holes was not applied to those working places using black blasting powder.

Two principal methods of shooting coal in rooms were employed—namely, the four-hole and the three-hole method. The latter was also used in the entries. These methods are shown in Figures 1, 2, and 3, respectively. There were many variations of the placement of holes. The 2 to 2½-inch holes were drilled by hand with augers mounted on posts. The holes were shot in the order indicated by numbers. Shots were fired by shotfirers after the miners had left the mine. Not more than three shots per working place are fired in a shift.

The practice in this mine was to use a permissible explosive of a medium rate of detonation, in 1¾ by 6½-inch cartridges, which were fired by a No. 6 detonator crimped to double tape fuse. In the four-hole method, the low hole is called the "snubber," the high hole away from the rib the "breaker," and the two high holes near the ribs, the "rib holes." The "high" holes were generally started 1 or 2 feet from the roof, and were slanted upward so that the back of the holes were near or against the roof. In practice, where the undercut "gripped" into the rib on the edge of the undercut, the miner bored the rib hole "gripping," and at such an angle to the rib that the back end of the hole was often on the "solid."

*Explosives Testing Engineer, Pittsburgh experiment station, Bureau of Mines, Department of Commerce.

†Assistant engineer, Bureau of Mines.

‡Tiffany, J. E., and Nelson, C. W., Efficiency in blasting coal, production of lump coal. Bull. 11, Carnegie Inst. Tech., 1924, 48 pp.

It was the general practice where the three-hole method of shooting was employed, to start the snubber hole 3 feet from the floor and slant the hole up so that the back of the hole would be about 5 feet high. With a three-hole method this appeared to be the only successful procedure. The average total weight of explosive used for shooting a cut in a room was 6½ pounds. Charges of two pounds or more were used in some of the holes. Poor blasting efficiency resulted from improper placement of holes, overloading, and insufficient stemming.

Placing and Loading Holes

Tests were made to determine the best methods of placing and loading the holes, and two methods of placing holes are shown in Figures 4, 5, and 6.

For the method of drilling shown in Figure 4 an air space was left between the explosive charge and the stemming. This was done by inserting a copper-wire spacer 18 inches long between the explosive and the stemming. Five rounds were fired for each of three permissible explosives which had a low, medium, and high rate of detonation, respectively. The cartridges used were 1¾ by 6½ inches. Other tests were made without the air space, so that a comparison could be made by observation.

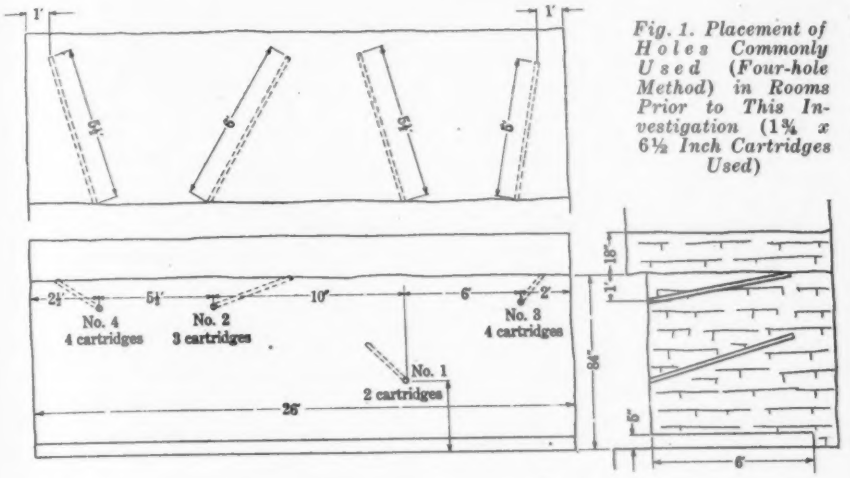


Fig. 1. Placement of Holes Commonly Used (Four-hole Method) in Rooms Prior to This Investigation (1¾ x 6½ Inch Cartridges Used)

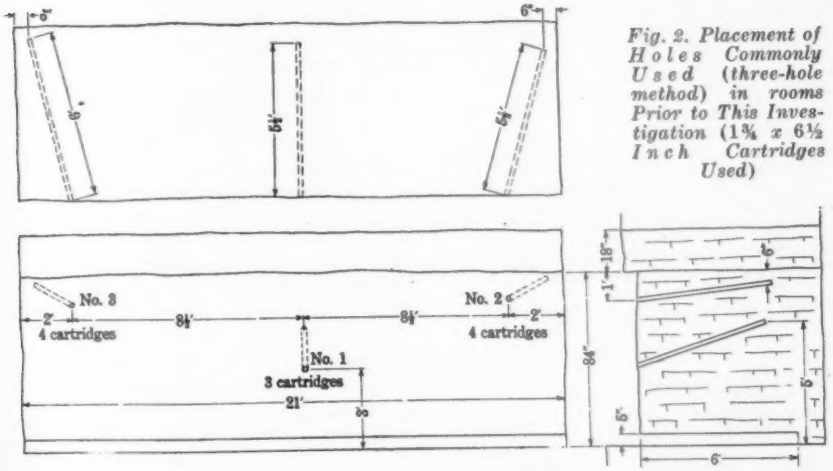


Fig. 2. Placement of Holes Commonly Used (three-hole method) in rooms Prior to This Investigation (1¾ x 6½ Inch Cartridges Used)

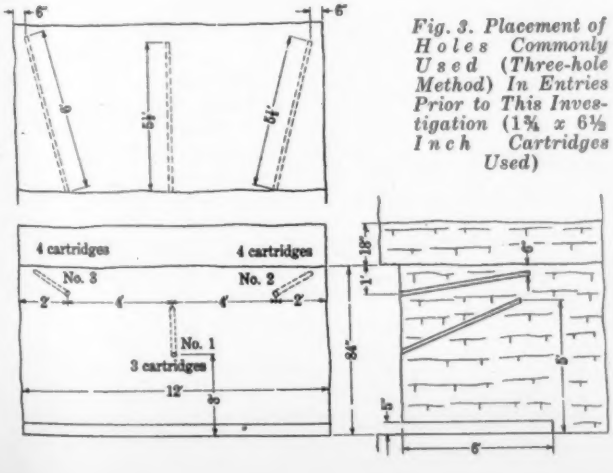


Fig. 3. Placement of Holes Commonly Used (Three-hole Method) In Entries Prior to This Investigation (1¾ x 6½ Inch Cartridges Used)

Observations made after shots indicated that more lump coal was produced by air-spacing, but little difference could be observed between explosives of low, medium, and high rate of detonation when the same weight of charge was used for each round, excepting that when the explosive with the high rate of detonation was used there was slightly more shattering of the coal. In order to obtain the effect of the air-spacer a cartridge of smaller diameter was used, as described under the standard method of shooting, which was recommended.

Standard Method Adopted for Shooting the Coal

The standard method adopted had been used to a limited extent in the mine for two years, and was devised by the mine manager during a previous campaign on lump coal. It was, however, never previously used to the exclusion of other methods. The position of the holes for this method is shown in Figure 5. The order of firing each hole is indicated, and was obtained by the use of fuse of different lengths. A limited number of tests were made in which the holes were shot in a different order, and while no definite conclusions were drawn, this modification seemed to have some advantages. By this modified method the snubber shot (No. 1) was fired first and then the breaker shot (No. 3). The coal that was shot down was loaded out before firing shots two and four.

Use of 1¼-Inch Diameter Cartridges

Theoretically, the use of a cartridge of smaller diameter should result in the production of more lump coal because when the same weight of charge is used, a change from a 1¾ by 6½-inch cartridge weighing 8 ounces to a 1¼ by 8-inch cartridge weighing 5 ounces, approximately doubles the length of charges.

Tests indicated that more lump coal could be produced by the smaller cartridge. After the standard method of drilling and shooting had been established, the smaller cartridge (1¼ by 8-inches) was issued to the miners in small quantities. These were gradually increased until the 1¼ by 8-inch cartridges were used almost exclusively. Personal instructions to the miner were given at the time of the issuance of the smaller cartridges.

The percentages of different sizes in this table are based on the total quantity of coal produced by the entire mine as weighed on the tipple, and the weights of the various sizes as weighed in railroad cars in the mine yards. In a review of the results, consideration should be given to the following conditions:

While this investigation was started about September 1, no attempt was made to change the shooting practices until the middle of November, when the introduction of a standard method of drilling and shooting was begun.

During November there was practically no apparent improvement in the quantity of lump coal. However, during December, results from a standardized practice became apparent, when the 6-inch lump coal amounted to 12.81 percent, an increase of 1.53 percent above the average for the first 10 months of 1924. Some of the increase may be also partly due to the use of 1¼-inch cartridges instead of 1¾-inch, as the cartridge of smaller diameter was introduced gradually during the latter part of the month.

The quantity of 6-inch lump coal for January was 13.28 percent, an increase of 2 percent. This was apparently due to the standard methods adopted, together with the reduction in cartridge diameter from 1¾ to 1¼ inches.

The Bureau of Mines work was brought to a close about February 1, 1925, after which it had no representative at the mine. However, during February there was an increase of 1.97 percent, which made the proportion of lump coal 13.25 percent. The results obtained in February are undoubtedly due to continuance of the standardized methods.

Discussion

The improvements which were made through this investigation, together with the application of the standardized methods worked out, increased the proportion of 6-inch lump coal for the entire output of the mine during January and February, 1925, by approximately 2 percent above the average for the first 10 months of 1924.

Four factors were directly responsible for this improvement, as follows:

1. Introduction of a standardized method of shooting and blasting.
2. Closer supervision.
3. Introduction of a cartridge of smaller diameter and the use of an air space around the cartridge.
4. Cutting down explosive charge.

Where it is desired to increase the percentage of large sizes, factors 1 and 2 must be considered together as a standardized method allows of closer supervision, and experience has shown that this closer supervision is necessary in any attempt to increase the larger sizes. The advantage of cartridges of smaller diameter lies in the fact that the explosive force is cushioned and distributed over a greater area of coal.

Observations made in the early part of this investigation showed that in most cases the drill holes were considerably overloaded, which resulted in breaking the coal more than was necessary. Tests carried out by the writers showed that with the cartridges of similar diameter the coal could be brought down with certainty, when the explosive charge had been reduced approximately 30 percent. With cartridges of 1¼-inch diameter a further reduction of 25 percent could be effected, while a study of the table shows that the quantity of explosives used was decreased 10 percent.

Recommendations

Coal-mine operators desiring to increase their production of lump coal should consider the following suggestions:

1. Standardize drilling and blasting practices.
2. Supervise closely.
3. Do not "grip" the undercut at the ribs; it should be of uniform depth.
4. Clean out the "bug dust" by removing it with a scraper or long-handled shovel before shooting.
5. Load out all coal after each shot.
6. Do not "grip" the rib holes.
7. Drill holes parallel to bedding planes.
8. Do not overload holes with explosive; overloading will decrease amount of lump coal.
9. Tamp the holes to the collar with incombustible stemming.

(*Continued on page* 499)

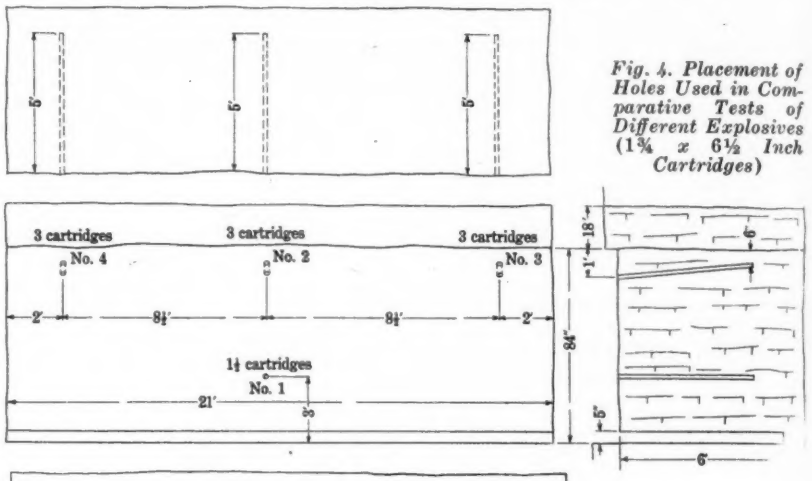


Fig. 4. Placement of Holes Used in Comparative Tests of Different Explosives (1¾ x 6½ Inch Cartridges)

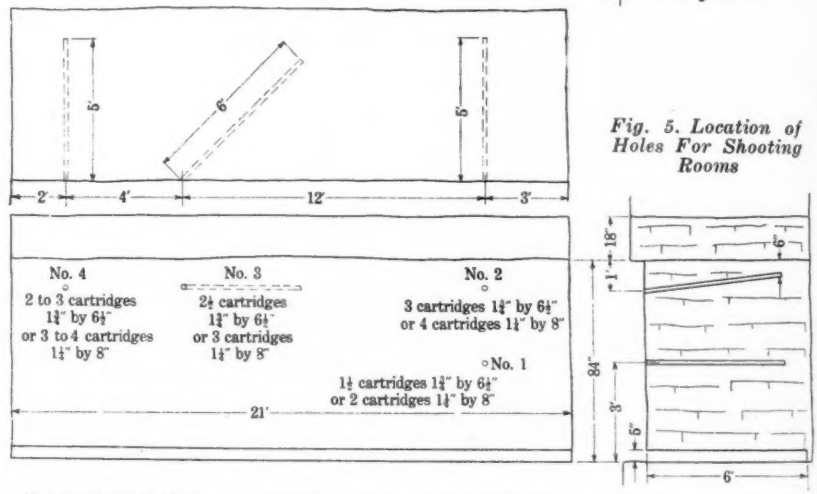


Fig. 5. Location of Holes For Shooting Rooms

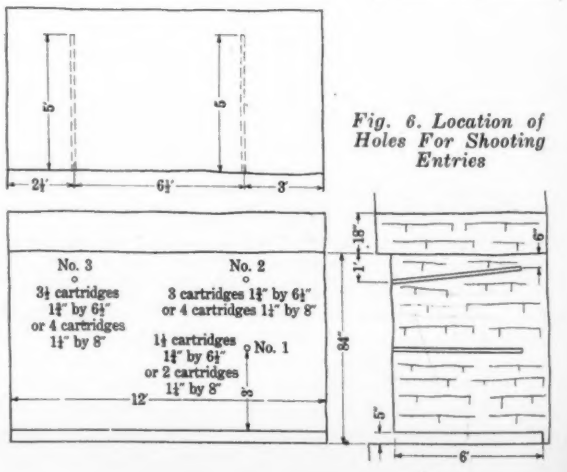


Fig. 6. Location of Holes For Shooting Entries

THE NATION'S VIEWPOINT

A Digest Of The Expressed Opinions Of Leaders In American Affairs

LITTLE surprise and much condemnation is the tenor of the editorial comment of the press in regard to the walk-out of 158,000 anthracite miners on September 1. In the anthracite industry alone this means a loss of wages of $1,200,000 per day and, in addition to the mine workers, throws out of employment thousands of railroad employes and workers in allied industries. *Coal Age* believes that barring intervention victory will be on the side having the longest purse and the greatest endurance. They further feel that the public should not complain, pointing out that:

"Although the public now moans that the miners and the operators have completely disregarded its interests in the controversy, the fact is that the public, by its earlier inaction, has definitely stated its position. The operators entered the wage conferences with two announced objectives—arbitration of all questions upon which the conferees could reach no agreement so that a suspension might be avoided, and opposition to any changes which would increase the cost of coal to the consumer. To neither proposal would the miners give their assent. To the first proposal they voiced a most vigorous, not to say bitter, dissent. After trotting out a few old friends, such as freight rates, profits and the hazards of the industry, the miners made it plain that they would not agree to the stopping of the steady advance of wages.

"The public was frankly enamored with the proposal to check increases in fuel prices. It seemed, for the most part, strangely indifferent to the suggestion to avoid a suspension. Its attitude, reflected in the nonchalance in evidence at Washington and Swampscott, was one of 'let 'em fight it out; we should worry.' When the public and the administration might have thrown the weight of their influence on the side of arbitration as public protection against an interruption to the production of hard coal, both were silent.

"Since the public, in the weeks during which the operators and miners were meeting at Atlantic City, elected to adopt a 'hands off' policy, the industry today has the right to demand that the public and the administration at Washington continue that policy of noninterference. The pressure that in times past has compelled the operators to agree to settlements framed in a spirit of fear should not be exerted. Friendly offices, of course, are always in order, but the public has surrendered whatever right it may have had to dictate terms. A sense of fair play should keep Washington as calm when excited New England Congressmen descend upon it with the cry of 'peace at any price' as it is today. The public acted as if it knew what it wanted; let it not later complain of the bargain."

Coal Mining Review does not believe that strikes have added anything to the welfare or the uplifting of the coal mine worker. T. L. Lewis, former secretary of the United Mine Workers of America, now editor of this paper, says in a recent editorial:

"Strikes in the coal industry have never been as successful as joint negotiations of operators and miners in securing the best terms of a wage contract for all parties interested, and especially for the permanent and best interest of the mine workers. The history of the development of the coal industry, and the different efforts made to organize the miners, will prove that strikes have not been as much of a success in promoting the welfare of the miners as the negotiations of representatives of operators and miners, who were sincere in their efforts, to reach an agreement in harmony with the facts presented by both the miners and operators in a joint conference."

That the coal strike, which began on the part of the miners in a holiday spirit, is beginning to show some serious phases is pointed out by the *Washington Post*. They assert that:

"Merchants throughout the mining districts involved are tightening the credit they have been accustomed to extend to workmen. This will lead to larger and more insistent drafts upon the defense fund of the union, and if the strike should be prolonged a season of actual suffering is in store for the victims of this controversy.

"In round numbers, the anthracite coal industry represents an investment of half a billion dollars. Necessarily it will be subjected to continuing overhead expenses and maintenance charges while the mines are closed. The industry claims that these charges may be "conservatively" set down at $8,000,000 a month. Some idea of the cost of the shutdown to the miners may be obtained from the fact that for the strike of only three weeks' duration in 1923 the loss in wages alone amounted to more than $13,000,000. The daily loss in coal production today is estimated at about 300,000 tons.

"Approximately 160,000 hard coal miners are now out of work in obedience to strike orders. Their daily wage loss is estimated at $1,000,000, while the State of Pennsylvania loses $20,000 daily in tonnage taxes. The railroads

N. Y. Evening Post

Just Exercise

announce that the shutdown of the mines will compel the lay off of about 10,000 of their employes of various kinds engaged in operations on mine runs, which have been rendered useless while there is no commodity for them to haul.

"The loss in purchasing power of the people of the hard coal district, located in but a very few of the Pennsylvania counties, has been fixed by those familiar with the situation at approximately $5,000,000 each week that the strike continues. What this means to business and its effect upon the welfare of the people generally is easily imagined. This crippling of the power to buy and sell goes far beyond the boundaries of the territory immediately affected and may produce conditions that will be felt in some measure throughout the country.

"Producers of soft coal are now in conference with a view to arranging to meet the necessities of the market usually supplied by anthracite. There seems to be little likelihood of a disturbance in the bituminous fields, and with an intelligent use of fuel substitutes, and a cheerful cooperation between retail coal dealers and the consumers, actual suffering should not result."

Major W. W. Inglis, spokesman for the anthracite operators, in an official statement after the strike was declared on September 1, stated that:

"More than 150,000 men are out of their jobs. When evening comes these men will have lost $1,200,000 in wages. That is the daily pay roll of the anthracite mines.

"Not only will the miners and mines lose, but business of all kinds will suffer. This misfortune comes upon us all because the miners' leaders refused to allow the mines to keep going while a new contract was being made."

The *Chicago Journal of Commerce* takes violent issue with John L. Lewis' dictum "Surrender—or Strike," and urges arbitration. Their editorial follows:

"John L. Lewis speaks again. He utterly refuses to arbitrate. He utterly refuses to resume negotiations unless the operators surrender in advance. And, having made this astonishing reply, he sits back and waits for a frightened public to clamor for Government intervention and thus compel the operators to yield.

The Cleveland Plain Dealer

"We Like It"

"Mr. Lewis refuses to resume negotiations with the operators unless they consent in advance to another raise in wages. The amount of the raise may be determined later in negotiations, but there will be no negotiations unless the operators agree to give a raise of some sort. Not only that, but they must agree in advance to adopt the check-off system, whereby they would collect the miners' union dues from the wages and turn the dues over to the union.

"Unless these demands are accepted in advance, there will be no negotiations. And under no circumstances will Mr. Lewis arbitrate.

"Having made these utterly inexcusable demands, John L. Lewis sits back and waits for a panic-stricken public to force a Federal Government to call on somebody—meaning the operators—to yield. If any Federal officials want somebody to yield, Mr. Lewis is the man they should talk to."

Washington Star

Dog Days

The *New York Evening World* finds little to approve in the attitude of the United Mine Workers in their refusal to arbitrate their differences, saying:

"The public will find nothing to approve in the latest note from John L. Lewis, leader of the coal miners' union. One paragraph in particular is objectionable in content and even more objectionable in tone. Mr. Lewis writes:

" 'We really do not care to arbitrate. Thanks for the offer. We know that you think the medicine would be good for us, but frankly, we have little faith in your diagnosis. It will be long before we recover completely from your previous arbitration treatment, and until we do we will modestly decline to accept your prescription.'

"If Mr. Lewis were deliberately trying to alienate public sympathy to a degree where any proposal for Federal regulation or control of the anthracite mines or the profits of the operators would receive a hostile hearing, he could hardly have chosen words better fitted to achieve such a result. Indeed it is not impossible that such was his intent."

Pointing out that public opinion is the biggest weapon that the President of the United States has in dealing with any situation, the *Washington (D. C.) Star* states:

"The big stick in the hand of any President is after all merely the support of public opinion. If the public is not back of the President his influence in any crisis is comparatively small. In the absence of law, the force of public opinion, however, frequently is enormous. The public today is desirous above all to see that the coal supply continues unchecked. It will back the President in any demands he may make upon the operators and the miners."

The *Boston Post* fails to understand the miners' attitude in having clamored for arbitration in previous years and their attitude of arrogant rejection this year. Editorially they state:

"Why the miners, having

N. Y. Evening Post

A Tedious Task

Sioux City Tribune

Tuning Up

clamored for arbitration in the past when they could not get it, should refuse it now when they can is a mystery.

"It may be that President Coolidge can succeed in getting a square deal for the public in this present situation. If he can he will win enduring fame as the one man who settled a coal strike without taking it out on the public.

"Is that too much to hope for?"

That arbitration is an entirely reasonable proposal and that it should have been accepted by the United Mine Workers of America as a matter of course, is the trend of the editorial comment in the *Indianapolis* (Ind.) *News*, which says:

"The people have all the facts they need in order to reach the conclusion that an anthracite coal strike at this time is wholly unjustifiable. If expressions of public opinion are desired by the parties to the controversy, those expressions should be forthcoming. The more vigorously public opinion presses for this the greater will be the probability of agreement. It is to be noted that though the representatives of the miners profess to see no way out, and regard a prolonged strike as inevitable, they have constituted a committee with full power to negotiate and come to agreement with the operators."

The *American Metal Market* believes that the anthracite suspension will be helpful in leading to a final settlement of the "coal problem." They point out that:

"It is really astonishing that with the volumes that have been written about coal the writers have suceeded in avoiding the human element, which is the one that ultimately controls in everything. The mental attitude of the operators, of the officials of the United Mine Workers and of the public ought to be studied.

"It has not been.

"As to the public, there have been hundreds of thousands of words written arguing what a good thing it would be if the public had a voice in coal matters, and pretending to argue that it has rights, but the argument has been what may perhaps be called "technical." Now, when the public is ready to act it does very little arguing.

"As to the mental position of the coal operators there are two vital points. The typical or average coal operator is unlike the typical or average manufacturer in two respects. First, the manufacturer is almost invariably one who has selected his line because he likes it and feels he is fitted for it, and that is a natural sequence for usually one can do the thing he likes to do. Many coal operators, on the other hand, have gotten into the business of producing coal because they chanced to own coal land. They were not necessarily fitted.

"Second, the typical manufacturer is building up a business for indefinite continuance and expansion. No manufacturer expects to make during his lifetime or in a shorter period all the goods of that class posterity will want. The coal operator on the other hand is engaged in exhausting a coal acreage. The time may be shorter or longer but there is a visible end and each day of production brings him nearer to it.

"These two are fundamental and very vital differences. They have made it that coal operators are decidedly different in mental attitudes from the producers of commodities in general. Since we have to deal with men if we are to settle the coal problem, that fact should be given prime consideration.

"Finally, we have the mental attitude of the officials of the United Mine Workers. The reference to the officials alone is made advisedly. The rank and file of the so-called "members" does not have a mental attitude worth considering. The membership is produced by that very curious thing, the 'check-off.' It is not dreamed of as to other classes of employment and it does not flourish abroad where, if anywhere, one would look for it. The ambition of these officials is to get all they can for their membership year by year. There is

no occasion to think of the future. All the present members will die in time and those who do not like it need not die to get out. It costs nothing to quit.

"This new coal strike makes more trouble and forces the the thing nearer to the final settlement and when that settlement comes it will be found that there was very little argument or reliance on precedent for it."

Black Diamond editorially agrees with a statement in the Wall Street Journal which they reprint in their editorial pages, in believing that John L. Lewis is making a tremendous mistake in attempting to extend his fighting front to cover the bituminous coal industry and to prevent any revision of the Jacksonville agreement. They feel that in his so-called strategy he has overlooked some fundamental facts which they sum up as follows:

"No important problem in the soft coal industry was settled by that agreement. It simply put off to March 31, 1927, matters which should have been settled before. How it has worked in practice can be seen in the closing down of union mines and in the working of the non-union, which, although paying a lower wage scale, yet gave reasonably steady employment. It is because of this agreement that two of the largest, best equipped and most efficient companies in the soft coal fields, since the first of this year, found it necessary to pass their dividends and close down most of their mines. They could not continue in business when they could not mine coal at a profit.

"But this is a situation that Mr. Lewis refuses to recognize, while fighting to perpetuate an uneconomic arrangement. In fact, when last year the Coal River Collieries Co., which, by the way, is owned by the Locomotive Engineers Brotherhood, wished to revise that wage agreement, he flatly told them that the workers had no responsibility in the matter of production costs. Apparently he shuts his eyes to the fact that wages come only from production, and when costs are greater than selling prices production must cease.

"There is one thing that seems to be overlooked in the bituminous field that will render any wage settlement a difficult matter. The industry is overextended and overmanned. There are enough soft coal mines open to produce twice as much coal as the country can consume. There is no hope that in the near future industrial demand can catch up with this potential production.

"There are over 700,000 men in the soft coal fields to do the work that less than 500,000 could do if working full time of about 300 days a year. Instead of drawing wages for full time, the work must be divided so that there is an average of about 153 days a year to a man. Here is a tremendous economic waste, as well as hardship to the workers. High wage scales written into an agreement can not cure this evil because they can not increase the consumption of coal a single pound.

"This matter of overmanning the industry must be met and cured before there can be any permanent solution of the soft coal troubles. In fighting to perpetuate the Jacksonville agreement Mr. Lewis is only weakening his own lines."

HELLO? FEDERAL GOV'T INCOME TAX DEPT? SORRY BUT I LEFT OUT A FEW FIGURES— WAIST LINE 38. BEST GOLF SCORE 106. HAVE 2 MOLES ON LEFT SHOULDER BLADE. 2 DIVORCES. HAVE 1½ QUARTS OF HOME BREW IN BASEMENT. MY 2 LITTLE TOES BEND IN. HAD 2 TONSILS REMOVED, ALSO MIND I MANS BUSINESS AND—AND..
INCOME TAX PUBLICITY

N. Y. Tribune

Making It Complete

The *Wall Street Journal* asserts that the termination of the agreement between the anthracite miners and the United Mine Workers does not automatically establish a strike, saying:

"An agreement between the anthracite miners and the operators terminates, and Lewis claims that this establishes a strike automatically. It does nothing of the kind, as the old wages are still available. The coal operators will not consent to the addition to the old agreement of the "check-off," which means collecting union dues and fines — especially fines—from the miners' wages. The collusive State of Pennsylvania, by the Miners Certificate Law, excludes the employment of strike breakers and stands to win on the collection of higher taxes if higher wages can force the consumer to pay more for coal.

"The consumer has found the facts and he can find the coal, to say nothing of substitutes. The railroads will deliver to New York or to New England a high-grade bituminous coal, amply sufficient to see the consumer through the winter even if there were not a winter's supply of anthracite on hand.

"There is no need for Government interference, and the President knows it. There is no need for talk of legislation, because that is in the hands of the Pennsylvania Legislature, which does not meet until 1927 unless called together by the Governor in special session. That is the last thing Pinchot will do, as he showed by the granting of the utterly unwarranted and unearned wage advance in 1923."

That the nationalization of mines is not a solution to Britain's and America's coal problem is pointed out by the *Dearborn Independent* in a recent editorial, in which they say:

"A Briton has looked over industrial England, with this result:

"In a coal mine where every American method is employed, 3,000 tons less are produced in a year than before the war.

"The actual price of coal produced in this country at the pit's mouth is 24 shillings a ton. In America it costs 12 shillings a ton.

"Three hundred bricks are laid in a day, as against 600 in America.

"Three hundred tons of coal are obtained, against 600 in America.

"These figures may be more palatable to Britain than words of advice from this side. 'Actions speak louder than words.' But it is rather curious to see the reaction of a noted British editor to the above. The only solution he suggests is 'the nationalization of mines and railways.' But there is no nationalization in the United States, and if there were the production record would go down. Are Governments such supremely good managers that we can safely turn great industries over to them? In its hidebound capitalistic class and its equally hidebound labor class both British capital and labor are, for all practical purposes, nationalized, with results that neither likes."

AW BOSS GEE WHIZ, I'VE A HEART - AIN'T I ALMOST DOWN TO FORM YET?
SHUT UP! SNAP OUT OF IT! MORE PEP! FASTER!
NATIONAL BUDGET
TRAINER
CAL

Wallace Press-Times

A Tough Trainer

Wallace Press-Times

Nothing Beats a Fence

That the strike of the anthracite miners in Pennsylvania has a far deeper meaning than appears on the surface is the view of the *Manufacturers Record*, which in a recent editorial says:

"The strike of the anthracite miners in Pennsylvania has a far deeper meaning than appears on the surface. In connection with the constant strikes in the bituminous coal fields there is a definite combination, if not conspiracy, to put the entire country, all interests and all industries, under the absolute domination of a comparatively few radical men controlling hundreds of thousands of operatives, most of whom, like puppets, jump as the string is pulled from the headquarters of radical unionism.

"No substitute has yet been found for coal except to a limited degree. It is still true, as it was when the statement was first made, that the measure of a nation's civilization or development is its consumption of coal. Hydro-electric power supplements, and in some places supplants, coal, but electric power and light generated by coal will in the future probably exceed the total that can be generated by water power. There is a limit to which hydro-electric development can be carried. It is based on the potential power of all of our streams when fully utilized, but so vast is our coal supply that there is scarcely any limit to which the production of electricity for power and light can be carried through the steam plant.

"It is true that new inventions are coming to the front which may almost revolutionize our power development, but so far as the world can now see coal must be the foundation for a large part of the material advancement of this and other lands.

"The strike in the coal regions, therefore, has a peculiar bearing upon the prosperity of every phase of American life."

Among the many items of special interest when reviewing what the Fordney-McCumber tariff bill has done for the mining industry, perhaps the most conspicuous is that of the manganese industry. This item was one of the most bitterly contested in the whole metals schedule of the present tariff law. That its advocates were sound in their conclusions is the view of the leading exponent of the iron industry, the *Iron Trade Review*, which in an editorial in their July 30 issue, entitled "Tariff Aids Manganese Producers," says:

"Under a protective tariff producers of high-grade manganese ore in the United States are shipping more of their product than for several years. Shipments in 1924 amounted to 56,515 tons, an increase of 79 percent over the total for 1923, and in 1923 the gain was more than 100 percent over 1922. Mines that were unable to operate before the tariff went in effect now find it profitable, and a further increase in output is indicated. The tariff is accomplishing its purpose evidently, even though steelmakers feel it is penalizing them to support the domestic industry that otherwise could not compete with the foreign producers. Reports to the Department of Commerce show that the first large shipments were made from the State of Washington in 1924, while Montana, the principal producing state, made the largest contribution to the total increase. New operators now are engaging in the industry.

"To what extent the tariff is influencing the shipments of manganiferous iron ore from the Lake Superior district is conjectural. The percentage of this grade of ore from the Cuyuna Range is increased from 11.6 in 1921 to 49.4 percent in 1924. A larger proportion of such ore is being used in the blast furnace to increase the manganese content in basic iron. Certain manufacturers have found it more economical to do this than to add ferromanganese in the ladle. In this way the tariff indirectly is accountable for a portion of the increase in the use of Lake Superior manganiferous iron ore."

Along this same line, the *American Economist* says that two years is a very short time in which to judge the effects of the tariff on such a product as manganese, and further say:

"Under the protection afforded by the Tariff Act of 1922 the production of manganese in the United States is

Chicago Daily Tribune

Going Through His Clothes

Washington Post

Close the Book, Uncle Sam

steadily increasing. Free-Traders allege that the tariff is a failure because the domestic production is not nearly great enough to supply the demand. Like they did with regard to the tariff on tinplate, they are inaugurating a campaign to have the duty repealed.

"Two years is a very short time in which to judge of the effects of the tariff on such a product. Prior to the adoption of the Tariff Act of 1922 manganese ore was free of duty and, as a consequence, but little of it was mined. The statistics show that the total value of all the manganese produced in the United States in 1909 was $31,000. Let us see how its production has increased since the present tariff went into effect. In 1924 the total value of manganese ore produced in the United States was as follows: Ore containing 35 percent or more of manganese, $1,307,477; ore containing 10 to 25 percent manganese, $929,390; ore containing 5 to 10 percent manganese, $1,713,943; total, $3,950,810.

"It would seem to us that an industry which has grown in two years from practically nothing to a value of nearly four million dollars is one worth encouraging."

The cheering words of the *American Zinc, Lead and Copper Journal* in its leading editorial, are as balm to an industry that has suffered four years of depression. This Journal believes that there is a decidedly brighter outlook for metals production and proves their case, saying:

"Struggling through crises that have handicapped and upset the metal markets and cast a damper over the business prospects of both America and Europe, the great industries of the United States are preparing for an era of activity that means better times for mining, smelting and manufacturing of all kinds.

"At no period in the history of this country has there been such a bright and promising outlook for building. Never has there been such vast sums of money appropriated for improvements in the way of homes, factories and buildings of every description. All of this means better markets for zinc, lead and copper, much of which is required for modern structures.

"The long dull period through which the mining industries have had to pull is rapidly passing away and a brighter outlook follows the passing clouds which are being dispelled by the dawn of the new era of business prosperity. The bankers have held a tight rein on the money markets but with the coming harvest the clutch on the money bags will have to loosen and more money put in circulation than the country has had since the extravagant times of the early war months.

"The business situation appears sound, and the outlook for autumn business cheerful. These conditions are reflected in the price policies of metal producers. Increased buying of steel, tremendous car loadings, larger structural lettings, active markets in wholesale merchandise, are some of the signs of the times.

"The political atmosphere of Europe has been steadily clearing and there is hope for further progress, but business and labor conditions are full of trouble. But labor is no longer the dominant factor that it was a few years ago. The power which the masses of the American people let slip away through lethargy is going to go back to the people.

"Europe lags a little behind the market here in bidding on each rise, but it will be noticed that American smelters are not accepting their business at cut prices. The foreign buyers are more dependent on us than we on them. The only trouble has been that American producers have allowed their small surplus of metal to be thrown on the European market at any price they could get for it, but they have stopped this practice, and are in consequence building up both domestic and foreign markets to a point where they should soon realize a fair profit while paying a fair price for ore.

"All metals are moving into strong markets, with higher prices in prospect.

"Buying for early use is characteristic of all metal markets with a little more interest (*Continued on page* 498)

SALT LAKE MEETING OF INSTITUTE

Mining Institute Convention—Salt Lake Meeting Considers Problems—Mine Camps Inspected

IMPORTANT questions concerning mining and metallurgy were considered at the 132d annual summer meeting of the American Institute of Mining and Metallurgical Engineers which was held at Salt Lake City, Utah, from August 31 to September 3. In addition to American delegates, the convention was attended by mining men from Canada, Mexico, China, South America and Africa, and in the opinion of officers of the Institute the meeting was the most successful held in recent years.

The program was varied and included the presentation of technical papers and tours of inspection of the famous mining district near Salt Lake.

The delegates inspected the Magna and Arthur plants of the Utah Copper Company at Bingham and the Garfield Copper Smelter of the American Smelting and Refining Co. Trips were also taken to Murray and Midvale where the smelters of the American Smelting and Refining Co. and of the United States Smelting, Refining and Mining Co. were examined. The plant of the Columbia Steel Corporation at Ironton was also visited. Another tour was made to the Tintic Silver Mining District at Eureka, where the Chief Consolidated mill and the various mines were inspected. The delegates also made a trip to Park City where they inspected the various silver-lead, and silver-lead-zinc ore operations.

A splendid program of entertainment was provided the delegates by the Utah mine operators.

The main sessions of the Institute were held at the Hotel Utah. The visiting mining men were welcomed by Governor George H. Dern of Utah, who stated that no nation had become great without mining. "We who are engaged in mining know how important the mining industry has been in the development of civilization," the governor said.

Development of the steel industry in Utah was predicted by John V. W. Reynders, president of the Institute. "This new industry will develop into one of great importance and enduring benefit," he said. "All of the materials necessary for the steel industry exist within the borders of Utah and all in a degree of purity that is unexcelled or unequalled in any other place in the United States."

J. C. Dick, chairman of the Utah section of the Institute, presided at the opening session, and L. S. Cates, of the Utah Copper Company and President of the American Mining Congress, was chairman of the session which considered technical questions.

A. B. Young, of the International Smelting Company, and W. W. Norton, of the American Smelting and Refining Co., were chairmen of the sections which considered metallurgical problems. G. W. Crane and James W. Wade of the Tintic Standard Mining Company, presided over the sections which discussed mining and geology.

An entertaining banquet marked the close of the convention. J. C. Dick was chairman and W. Mont Ferry toastmaster. The speakers were Mr. Reynders, Governor Dern and former Senator Charles S. Thomas of Colorado.

An interesting program, devoted entirely to technical subjects, was provided, and the speakers numbered many prominent western mining men.

MINERAL PRODUCTION IN MONTANA IN 1924

Bureau Of Mines Reports Decrease In Value Of Total Production, But Shows Increase In Copper, Gold And Lead Produced, With Decrease In Silver And Zinc

THE total value of the gold, silver, copper, lead and zinc in Montana ores treated or shipped, and of the gold and silver obtained from placer mining operations in that State in 1924, amounted to $55,074,548, a decrease of $2,738,422 from the 1923 output, according to statistics compiled by C. N. Gerry of the Bureau of Mines. A total of 4,652,482 short tons of these ores was treated or shipped in 1924, the figure being a decrease of 1,091,053 short tons as compared with 1923. The number of producing properties reported for the year 1924 was 388, which compares with a total of 382 producers reporting in 1923.

The recoverable copper in Montana ores treated in 1924 amounted to 249,152,062 pounds, an increase of 25,026,798 pounds over the 1923 output. The production of gold in the state in 1924 was 97,854.16 fine ounces, which is an increase of 12,774.73 fine ounces as compared with 1923. The 1924 silver output was 13,289,303 fine ounces, a decrease of 91,559 fine ounces from the 1923 figure. Recoverable lead in ores treated in 1924 amounted to 39,476,008 pounds, an increase of 3,530,385 pounds as compared with 1923. Recoverable zinc in ores treated in 1924 reached a total of 128,475,218 pounds, which is a decrease of 12,985,174 pounds from the 1923 production.

The great bulk of the output in 1924 was from Silver Bow County, with a total of 4,192,371 short tons of ore treated, producing metals valued at $51,575,310. Silver Bow County, in addition to ranking first in total production, also led all other counties in the production of the different minerals, the county being credited with 35,391.49 fine ounces of gold, 11,859,370 fine ounces of silver, 247,364,955 pounds of copper, 27,297,289 pounds of lead, and 127,835,887 pounds of zinc. Jefferson County ranked second in gold production, its output being 33,593.97 fine ounces; Park County, with an output of 10,046.57 fine ounces was third. The largest number of producers, 68, was reported from Madison County.

Mine Production of Gold, Silver, Copper, Lead, and Zinc in Montana in 1924, By Counties

County	Number of producers	Ore Treated Short Tons	Gold* Fine Ounces	Silver† Fine Ounces	Recoverable Copper Pounds	Recoverable Lead Pounds	Recoverable Zinc Pounds	Total Value
Beaverhead	20	36,842	192.10	77,547	191,027	3,534,401	.....	$363,704
Broadwater	33	8,166	976.35	22,438	4,042	563,367	12,240	81,609
Cascade	10	163,444	772.45	687,816	1,186,694	2,481,751	8,264	797,839
Deer Lodge	10	12,590	2,699.91	77,615	178	.....	.....	107,837
Fergus	8	104	65.69	1,227	.....	1,192	.....	2,275
Granite	23	2,143	1,149.68	50,320	32,189	14,555	.....	62,861
Jefferson	46	93,691	33,593.97	291,921	325,509	806,698	374,027	1,021,526
Judith Basin	6	26,354	296.49	115,505	4,304	2,544,123	.....	287,611
Lewis and Clark	47	25,599	7,046.74	45,557	31,213	512,651	.....	221,293
Lincoln	5	33,254	376.60	35,912	377	1,198,721	244,800	143,705
Madison	68	3,193	2,001.42	14,736	9,151	267,210	.....	73,822
Meagher	5	1,073	21.52	926	1,235	129,622	.....	11,597
Mineral	15	117	281.79	355	.....	4,000	.....	6,383
Missoula	1	.....	19.20	.....	.....	.....	.....	397
Park	6	49,246	10,046.57	2,318	.....	8,368	.....	209,904
Phillips	2	3,946	2,356.73	45,373	.....	11,387	.....	80,904
Powell	28	308	417.86	9,204	359	74,119	.....	20,782
Ravalli	5	8	87.85	7	.....	.....	.....	1,821
Sanders	1	33	.....	1,153	834	26,554	.....	3,006
Silver Bow	45	4,192,371	35,391.49	11,859,370	247,364,955	27,297,289	127,835,887	51,575,310
Sweet Grass	1	.....	3.10	.....	.....	.....	.....	64
Toole	3	.....	56.65	3	.....	.....	.....	1,173
Total 1924	388	4,652,482	97,854.16	13,289,303	249,152,062	39,476,008	128,475,218	†55,074,548
Total 1923	382	5,743,535	85,079.43	13,380,862	224,125,264	35,945,623	141,460,392	‡57,812,970

* Includes placer production. † Average value of metals: Gold, $20.671835 per ounce; silver, $0.67 per ounce; copper, $0.131 per pound; lead, $0.08 per pound; zinc, $0.065 per pound. ‡ Average value of metals: Gold, $20,671835 per ounce; silver, $0.82 per ounce; copper, $0.147 per pound; lead, $0.07 per pound; zinc, $0.068 per pound.

CRUDE PETROLEUM PRODUCTION IN 1924

THE production of crude petroleum in the United States in 1924 amounted to 713,940,000 barrels, a decrease of 18,467,000 barrels from the 1923 output, according to final figures issued by the Bureau of Mines. The statistics were collected and compiled under supervision of G. B. Richardson of the U. S. Geological Survey, Department of the Interior, prior to transfer of the Division of Mineral Resources to the Bureau of Mines.

The heaviest output in 1924, as in 1923, was from the Mid-Continent field, which produced a total of 375,479,000 barrels, an increase of 27,019,000 barrels over 1923. All other fields registered declines from the 1923 figures. California again led all other states in the production of petroleum, its 1924 output of 228,933,000 barrels being a decrease of 33,943,000 barrels as compared with the year previous. Oklahoma ranked second with a production of 173,538,000 barrels, an increase of 12,609,000 barrels over 1923. Texas, with a production of 134,522,000 barrels in 1924 ranked third, its output being 3,499,000 barrels in excess of 1923 figures. Other leading producing states in 1924 were: Arkansas, 46,028,000 barrels; Wyoming, 39,498,000 barrels; Kansas, 28,836,000 barrels; and Louisiana, 21,124,000 barrels.

Imports of crude petroleum in 1924, according to the Bureau of Foreign and Domestic Commerce, amounted to 77,775,000 barrels, a decrease of 4,240,000 barrels as compared with 1923 importations. The great bulk of oil imports was from Mexico, from which country 73,979,000 barrels were received. Exports of petroleum in 1924 were 17,973,000 barrels, an increase of 588,000 barrels over 1923. Of these exportations 10,992,000 barrels went to Canada.

On December 31, 1924, there were 299,100 producing oil wells in the United States, which is an increase of 9,000 over the figures for the year previous. The average production of oil per well per day at the end of 1924 was 6.2 barrels, which compares with an average production of 6.6 barrels at the close of 1923. Pennsylvania, with a total of 74,350 producing wells, led all other states in number of wells. Oklahoma, with 60,500 wells, ranked second; Ohio, with 38,900 wells was third; Texas, with 20,350 wells was fourth; and West Virginia, with 20,000 wells was fifth. California, with an average production per well per day of 53.6 barrels, led all states from this standpoint. Arkansas wells averaged 33.5 barrels per day, and Wyoming wells 26.9 barrels. The lowest average daily production per well is reported from New York and Pennsylvania, the figure being .3 barrels.

The total value at the wells of the nation's crude petroleum output is placed by the Bureau of Mines at $1,022,683,000, an increase of $44,253,000 over the 1923 figures. The average value per barrel in 1924 was $1.43, which compares with an average of $1.34 in 1923. California, with an oil production valued at $274,653,000, led all states in this respect. The highest average value per barrel at the well in any state was in New York, the figure being $3.64. The lowest figure obtained, 94 cents, was in Arkansas.

Stocks of crude petroleum at the end of 1924 aggregated 400,738,000 barrels, an increase of 26,226,000 barrels over stocks held at the close of 1923.

The indicated domestic consumption of crude petroleum in 1924 was 747,516,000 barrels, an increase of 32,654,000 barrels over the year previous. Of this amount 643,719,000 barrels of crude oil were run to refinery stills. The remainder, 103,797,000 barrels, was chiefly used as fuel, but includes losses.

OIL SHALE BIBLIOGRAPHY

Alderson, Victor C., Colorado Oil Shales, Petroleum Times, London, August 8, 1925, pp. 227-228; The Colorado Oil Shale Industry, MINING CONGRESS JOURNAL, August, 1925, pp. 403-406; Review of Shale Oil, by R. H. McKee and others, Industrial and Engineering Chemistry, August, 1925, p. 876; Colorado Shales Hold Vast Store of Oil, The Oil Trade, July, 1925, pp. 60-61.

Carroll, Fred, DeBeque, G. R., Proposed Method for Covering Oil Shale, Engineering and Mining Journal-Press, August 22, 1925, pp. 299-300.

Demaret, Leon, Les Gisements, l'Exploitation et la Distillation des Shistes Bitumineux, Broxelles, 1925.

Kogerman, P. N., The Present Status of the Oil Shale Industry in Estonia Journal of the Institution of Petroleum Technologists, London, June, 1925, pp. 210-233.

National Oil Shale Conference, Sacramento, Calif., October 2, 1925. American Mining Congress, Report of Proceedings, 1925, Verbatim Report, pp. 435-482.

Oil Shale, Coal, and Lignite, American Petroleum, McGraw-Hill Book Co., New York, 1925, pp. 119-146.

Oil Shale Exploitation, Petroleum Times, London, July 25, 1925, p. 140.

Special Features of Australian Oil Shale, Petroleum Times, London, July 18, 1925, p. 117.

Thiessen, Reinhart; White, David; Crouse, C. S., Oil Shales of Kentucky, Kentucky Geological Survey, Series VI, 1925, pp. 1-117.

Winchester, Dean E., What the Government Naval Plant Means to Shale Mountain States Mineral Age. May, 1925, pp. 21-23.

NATIONAL DIRECTORY OF COMMODITY SPECIFICATIONS

THE National Directory of Commodity Specifications, which is being issued by the Bureau of Standards with the cooperation of the Bureau of Foreign and Domestic Commerce, is now on the press and will be ready for distribution on or about September 21, 1925.

This directory contains in convenient form information regarding the best known specifications for more than six thousand commodities. The book tells not only what specifications are in general use but also by whom they were prepared and where copies can be obtained. In it are conveniently indexed for ready finding about 27,000 specifications prepared by the Federal Specifications Board and the separate departments of the Federal Government, by state and city purchasing agents, public utilities, technical societies, and trade associations.

Summary of Commodities and Specifications Therefor

Decimal Class	Commodity Group	Commodities Indexed	Approximate No. of Specifications
000	Animal and Animal Products	350	1600
100	Vegetable Food Products, Oil, Seeds, Expressed Oil and Beverages	525	2100
200	Other Vegetable Products (except Fibers and Wood)	400	800
300	Textiles	275	1900
400	Wood and Paper	625	3300
500	Non-Metallic Minerals	725	3300
600	Ores, Metals & Manufactures (except Machinery & Vehicles	1700	6400
700	Machinery & Vehicles	800	2900
800	Chemicals and Allied Products	600	2400
900	Miscellaneous	650	2400
	Total	6,650	27,100

Copies of the National Directory of Commodity Specifications may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., by sending with the order, a remittance either in the form of post office money order, coupons (issued for the specific purpose of purchasing Government publications), express money order, New York draft, or cash—at the sender's own risk. It is important to follow these directions explicitly to avoid delay and confusion.

THE STORY OF SULPHUR

THE STORY OF SULPHUR is the title of the latest addition to the series of educational motion-picture films prepared by the U. S. Bureau of Mines. The film depicts vividly the various processes employed in the mining, transportation and utilization of a raw material of which 1,220,600 tons were used in the United States in 1924.

The film illustrates the methods employed in the sinking of wells to the sulphur beds. The workings of the Frasch process for the lifting of the sulphur to the surface are also clearly shown. This process consists in pumping superheated water through a pipe to the sulphur horizon and lifting by means of compressed air the sulphur thereby melted to the surface, where it is piped to large bins into which it pours in the molten state and cools.

A series of most interesting views shows the huge vats, 50 feet high, in which more than 1,000,000 tons of sulphur are stored at a time. The blasting of these enormous piles of sulphur, preparatory to loading the material into railway cars, is graphically depicted, showing the loosening of several thousand tons of sulphur in a single blast.

The talents of the motion picture cartoonist have been employed to illustrate the enormous and exceedingly varied use of sulphur in American industries. One such cartoon, for instance, brings out the fact that the sulphur annually consumed in the nation would make up a pile as large as the Capitol Building in Washington.

Copies of this educational motion-picture film may be obtained free of charge for exhibition by schools, churches, clubs, civic organizations and other bodies by addressing the Bureau of Mines, Department of Commerce, 4800 Forbes Street, Pittsburgh, Pa.

MOTOR GAS SPECIFICATIONS

A TENTATIVE change in the specification for U. S. Government motor gasoline, the principal feature of which is the elimination of the initial and end point requirements, has been voted by the Technical Committee on Lubricants and Liquid Fuels of the Federal Specifications Board following a meeting held July 14. The change, however, will not be put into effect at the present time as the Committee feels that it is necessary, before so doing, to purchase limited amounts of gasoline on the tentative specification for purposes of experimental tests. In voting the tentative change, the Committee was actuated by the consideration that if the gasoline meets the present distillation requirements at the 20 percent, 50 percent, and 90 percent points, it should be satisfactory to use. After the new specification has been tried out experimentally for several months, the Committee will again discuss the question and if possible come to a final decision in regard to changing the present specification.

The Technical Committee is composed of representatives of various Government departments interested in the purchase or investigation of lubricants and liquid fuels and of representatives of different technical societies and petroleum trade bodies. N. A. C. Smith, petroleum chemist of the Bureau of Mines, is chairman of the committee.

INTERNATIONAL FIRST AID AND MINE RESCUE CONTEST

(*Continued from page* 477)

the Madison Coal Corporation. Mr. Moorshead paid loving tribute to the work and memory of Dr. Joseph A. Holmes, the first Director of the U. S. Bureau of Mines. He recalled the changes in mining conditions since 1888, and commended the present activities for safety and conservation of life, and further said:

"Capable and loyal organization is the chief necessity for success in all of our endeavors, as it is among the teams of this particular gathering. The greatest efficiency and success from every point of view depends upon the technical ability of all the workers, coupled with the exercise of good judgment. Organization of men alone can accomplish but little good, unless provided with suitable fire-fighting and rescue apparatus, as well as first-aid equipment. When mines are so organized, both under ground as well as on the surface, many more lives as well as property will be saved than could be possible without them; in fact, an organization of men only becomes an asset of little value.

"Prevention of accidents can be best accomplished by the adoption of well-tried safety devices, and not only from a humane standpoint should all operating companies continually seek them, but they will result in profitable returns in more reliable working time, as well as in compensation figures.

"The Madison Coal Corporation investigates all serious accidents that come to its notice, and in conference we endeavor to find a preventive and avoid the possibility of such an occurrence at our properties; its mines are all thoroughly equipped with everything necessary for fire-fighting, rescue and first aid.

"A general safety inspector, and a safety inspector at each mine comprise the force. Those at the mine send daily reports of such matters as require attention to the general safety inspector, as well as copies to the general superintendent, district superintendent and mine manager.

"While the safety department is entirely free from the control of the district superintendents and mine managers, yet they are expected to immediately report all serious defects that need quick attention and to work in a spirit of friendly cooperation.

"To do this and obtain the best results requires tact, and this they are especially instructed to exercise.

"In our experience, accidents rarely result from failure of operating equipment or safety devices, but too often many serious ones occur through failure to observe orders and carry out the rules and regulations of the company.

"Our safety department is not confined to routine inspections, but includes the developing and testing of experimental safety measures in general, and is now cooperating with the supervisor of explosives, and they, together with the face bosses after experimenting with different methods of shooting, instruct the miners the best means of obtaining more coal with the use of less powder, and in some cases with less drilling. The use of shale dust and open-space method of tamping shots, has greatly reduced small local explosions and face fires, all of which is not only beneficial from an economical operating point but tends to reduce accidents."

Such a gathering as this year's meeting, cannot fail to impress the most casual with an appreciation of the work accomplished along this line since its inception 15 years ago. During this period, over 140,000 miners have been trained by the U. S. Bureau of Mines in first aid, and mine rescue methods.

An interesting side light was the opportunity to listen to the safety men from various coal fields discussing their methods. Mr. Frank Hillman, of the Woodward Iron Company, of Birmingham, Ala., described their system by which infraction of rules are handled. Cards are provided in three different colors, for use in the first, second and third offense.

Whenever a serious safety rule has been violated, the first card is filled out with the name of the violator, and the page and paragraph where the rule may be found. The safety inspector explains carefully just what has been done and the correct way of doing it. Notation of the offense is also sent to the superintendent's office and filed by the safety department.

A second offense brings a card of different color, and a third offense brands the employe as too careless to continue longer in the company's employ; a proceeding not unlike the revocation of an automobile driver's license. Mr. Hillman reports that this system has been productive of excellent results, and every employe is extremely careful to familiarize himself with the rules and to avoid receiving a card.

WILL THE STRIKE STOP COAL DEFLATION

(*Continued from page* 467)

which these public men knew to be wholly uneconomic.

If you reverse that process, it becomes obvious that if the public men had stood firm—had refused to lend the power of government to these labor leaders—the uneconomic demands could not have been forced. Without the ability to force these demands, the present leaders could not have held their sway over the ignorant and greedy minority which, of late, has dominated the union. And, with that leadership gone, the sensible union miners would not have abandoned their work and their markets to the nonunion miners, who were pleased with the gift of advantage which had been handed to them. And, with the union mines "in the running" and fighting to retain their markets, the nonunion field could not possibly have expanded as has just been described. The facts are as they have been stated. The logic of those facts is irresistible. The only remaining question is:

"Will the anthracite strike cause the old vicious order of things to reverse itself?"

The facts in that matter are also perfectly clear. The miners' leaders have demanded of the anthracite operators, principally, a 10 percent increase in wages. They called a strike when that increase was not conceded. But, the consumers of anthracite are wholly dissatisfied even with present prices. They have been going to other fuels rather than buy anthracite at that old price. They refuse, firmly, to pay anything more. Thus the public is not with the union—for the first time in a quarter of a century. The anthracite operators, convinced that they must hold wages in check or lose their business, are steadfastly refusing to make any concession unless a board representing the consumers—after an arbitration—shall approve the increase in the name of themselves and the other users. And, the administration has refused to lend the aid of the government to the ambitions of the miners' leaders. Instead, the Governors of six New England States solemnly, in public conference, advised their people—as a permanent policy—to turn away from the union mined anthracite to the nonunion mined low volatile coal and other fuels. Thus the power of the union seems to be broken at what was, until recently, its source.

Also, in a desperate effort to recover his lost position the leader of the miners has renewed his strike in the Fairmont field. It is sheer blindness to assume that this means anything more than the prelude to a sweeping attack upon the union bituminous field to try to resuscitate the Jacksonville scale. But, the call to strike in those fields is made to men who have been hungry and ragged—because idle—for the last 19 months. It is a call to those who have done little work to stop entirely—to abandon the field wholly to the nonunion men. And, it is sheer nonsense to suppose that the nonunion field, which now is approaching a monopoly of the market, will abandon its advantage to share it's field with those who have remained loyal to the union.

This means that the power of the union seems to be broken. If this proves to be the fact, it may be said with some certainty that the long-delayed deflation of the bituminous industry will have begun. Under that arrangement, the wage schedules in both divisions of the bituminous field will sink to a comparable level. Market prices will be comparable, of course. Then, truly, the market will be commanded by "the strong and low cost mines." The suspension—not the destruction—of the weaker mines for a long period will have begun. And that will be as near an approach to deflation as need be expected.

NATION'S VIEWPOINT

(*Continued from page* 494)

in futures than heretofore. Hand-to-mouth is an expression that has prevailed in all classes of trade this year, and to an extent it still is the rule, but purchases are larger than they have been in the past few months and confidence in the metal markets as well as in the business situation at large is causing many users to look a little farther ahead on their raw materials.

"The great bulk of buying is for use within a month or two, or mostly to cover orders actually at hand. So it cannot be said that buyers are speculating to any extent at all. And for this reason, with producers' stocks comparatively low, the metal market situation is sound.

"The buying is mostly for domestic use, and the rise in prices is largely on this account. However, the copper market is well supported by the London market and export buying for the Continent. The rise in lead is due in part to the fact that for a long time the European market has been so strong as to prevent imports into this country. Little zinc is going for export, but higher prices are largely the result of the ore situation, and Europe's demands for American metals, particularly zinc, are becoming more urgent. A new ocean freight rate on zinc ore is in prospect and if successful will give a new impetus to exportation of zinc ore.

"In the Tri-State zinc-lead district some of the big corporations that are endeavoring to provide themselves with ample acreage of mineral leases to meet all their wants for years to come, are adding to their holdings and getting as much as possible for future mining needs. The passing clouds are seen by the great industrial powers and the brighter outlook will soon be apparent to all."

With the new high price for copper of approximately 15 cents, this metal is now at a level where production is profitable. In an article by James F. Masterson, in the *National Financial News*, the statement is made that copper companies are now in better position than in any year since the World War, and further that:

"The copper industry has turned the corner. Copper metal has at last reached the 15-cent mark, the highest price in over four years. At this price, most producers can operate at a fair margin of profit, something they have been unable to do for a long time. Furthermore, the statistical position of the industry has improved substantially and indicates that there is little likelihood of lower selling prices for some months to come.

"The copper industry, like the oil industry, has suffered largely through overproduction. The leaders in both industries have been striving for some time past to bring output on a more even keel with consumption. Unlike the oil men, however, the copper producers appear to have remedied this condition, as the latest figures on surplus stocks show. In fact, copper production has been curtailed so sharply that it is now running far behind consumption.

"Another favorable element in the present copper situation is the fact that demand continues to expand at a record-breaking rate, despite the rising prices for the metal. Indeed, buying has taken a decided jump since the higher quotations went into effect. Buyers who had been holding back orders for needed requirements in the expectation of an easing off in prices were sadly disappointed and are now freely placing orders at current levels. This has been noted especially in the domestic trade. And it is expected that foreign buyers will follow suit, as copper is needed perhaps more badly on the other side of the pond than in this country.

"One of the most important features in the outlook for the copper companies is the enormous amount of copper needed for industrial rehabilitation and expansion in European countries. While copper consumption in this country is at a high rate, the potential market for the red metal in Europe is stupendous."

COAL MINE ACCIDENTS FOR FIRST SEVEN MONTHS 1925

ACCIDENT records of the Bureau of Mines covering the first seven months of the present year show a loss of 1,262 lives in the coal-mining industry, which is 225 less than the number reported for the corresponding months last year. Of the 1,262 fatalities, 929 were at bituminous mines and 333 at anthracite mines. The gross fatality rate for the seven-month period was 3.85 per million tons, as compared with 4.64 for the same period in 1924. The rate for bituminous mines alone was 3.38, based on a seven-months production of 274,468,000 tons, as compared with a rate of 4.43 and an output of 268,381,000 tons during the first seven months of 1924, indicating a reduction in the fatality rate of about 24 percent in the present year. The anthracite rate for the seven months, January to July, was 6.21 fatalities per million tons and the output of coal was 53,607,000 tons; during the same months last year the rate was 5.71 and the production of coal was 52,341,000 tons.

The accident records for January to July, 1925, show 9 major disasters, that is, disasters causing five or more deaths each. These 9 disasters resulted in a loss of 188 lives. During the corresponding months last year only 7 major disasters occurred, but, because of two explosions in which the death toll was unusually heavy, the aggregate number of lives lost was 408. The fatality rate per million tons, based exclusively on accidents causing five or more deaths each, was 0.57 in 1925 and 1.27 in 1924.

An analysis of the causes of the 1,262 fatalities in 1925 shows a very marked reduction in the per-million-ton death rate from explosions of gas or coal dust, the rate being 0.72 for 1925 and 1.41 for the seven-month period in 1924. A slight reduction in the fatality rate from falls of roof or coal is also shown by the reports. The fatality rates for haulage and explosives are slightly higher than in 1924.

INTERIOR CREATES COMPLAINT DIVISION

AN invitation for suggestions, criticisms and complaints regarding the varied activities of the Interior Department was extended to the public in an order issued by Secretary Work establishing a Complaint Division under the direction of the Department's Chief Inspector.

To encourage a free discussion of views by persons having business and coming into contact with the Department, the order provides that every suggestion or complaint from the public is to be the subject of consideration by the Division of Inspection, brought to the personal attention of the head of the bureau involved and to the Secretary.

"The activities of the Interior Department," stated Secretary Work, "are of immediate interest to a large number of persons, often far removed from the department. By reason of this it is believed there are lost to the Department through lack of personal contact helpful suggestions and criticisms that would come from those citizens whom the Department serves."

It was also pointed out that the primary function of the Department is efficient service to the people and none is better qualified to offer suggestions for its improvement than those who have occasion to do business with the agents of the Department and its various bureaus.

The order requests that suggestions and complaints be addressed to The Secretary of the Interior, Division of Inspection, Washington, D. C.

MINERAL LEASE RECEIPTS DECLINE

A REPORT by the Interior Department states that the receipts during the past year from mineral leasing on the public domain under the Mineral Leasing Law were $8,278,708. This is $5,353,132 less than the receipts from the same source during the preceding fiscal year.

The greatest decrease is from leases on public lands in Wyoming where the receipts declined from $12,270,500 in 1924 to $6,953,501 in 1925. A decline in the price of oil from a maximum of $2 per barrel during March, April, May, and June, to a maximum of $1.50 during August and September and $1.25 in October, November, and December resulted in the wells being closed temporarily, or in pumping to storage and holding for better prices. Leases on public lands in California showed a gain in receipts from $957,480 in 1924 to $1,037,007 in 1925.

Figures in the report represent the total receipts paid the Government during the year in royalties, bonuses, and rentals from oil and gas, coal, oil shale, sodium, phosphate, and other minerals. A comparative statement of the receipts by public land States follows:

State	1924	1925
Alabama	$85,460.00	$920.00
California	957,480.64	1,037,007.05
Colorado	33,513.46	71,284.73
Louisiana	2,295.75	925.31
Montana	225,501.30	172,684.19
Nevada		720.00
New Mexico	4,784.20	3,474.26
North Dakota	10,587.14	8,136.01
South Dakota	34.81	168.15
Utah	35,402.58	26,821.99
Washington	6,280.09	3,065.49
Wyoming	12,270,500.75	6,953,501.44
Totals	$13,631,840.72	$8,278,708.62

COLUMBIA RIVER BASIN PROJECT

IN a report submitted to Secretary of the Interior Work, a special commission on the proposed Columbia River Basin reclamation project declared that the time had not arrived when local and national interests required its construction.

The report points out that the cost of this project has been fixed at $193,260,000, which is $158 per acre and that the Bureau of Reclamation is not possessed of either the information needed to formulate a development plan as costly and complex as the one outlined for the Columbia River Basin. The commission making the report includes Elwood Mead, Commissioner of Reclamation, who is chairman, and John H. Edwards, Assistant Secretary of the Interior.

The Sixty-seventh session of Congress authorized, by joint Resolution, the appropriation of $100,000 for an investigation of the feasibility of what is known as the Columbia Basin irrigation project, in the State of Washington. The appropriation was made under the act of Congress dated February 21, 1923 (42 Stat., 1540). The investigation carried out under that appropriation has been conducted through a Commission appointed to look after details. This Commission now reports that the investigation has been completed, and transmits its findings to be reported through the President to Congress.

Prior to this appropriation the Columbia Basin project had been investigated by the State of Washington, which has expended $150,000 on this work.

INCREASING LUMP COAL PRODUCTION

(*Continued from page* 488)

The authors wish to express their appreciation for cooperation and assistance during the investigation, by the employes and officials of the mining company, and by Mr. L. D. Tracy, superintendent of the Central District Experiment Station of the Bureau of Mines.—Reports of Investigations, Department of Commerce, Bureau of Mines.

AUTOMATIC CONTROL OF D. C. CIRCUITS

(*Continued from page* 485)

them from the trolley and all locomotive and machine runners must be trained to keep their controllers in the "off position" where the circuit is not energized so that the breaker can be adjusted to differentiate between connected load and short circuits and insure correct operation.

NEWS OF THE MINING FIELD

A Résumé Of The Activities Of The Mining Industry And Items Of Interest In The Field

Colorado Coal Mines Non-Union

For the first time in the history of the State since the coal mines were organized there is not a union mine in Colorado. There are a few unions in the state but they have no contracts with operators and every mine is on a non-union or open shop basis.

This report is confirmed by John Gross, secretary of the State Federation of Labor.

At one time there were a few over 14,000 coal miners in the state and every mine but three of the large ones and some half-dozen of the smaller were organized.

Labor leaders say that work looking to the unionization of the mines will start this fall.

Road to Tap Utah Coal Deposits

The Utah Construction Company has been awarded the contract for building 26 miles of railroad for the Denver & Rio Grande Western railroad, from Castle Valley to Nioche, through Salina canyon, Utah. The construction company graded this same stretch for the old D. & R. G. 25 years ago. No track was laid upon it, as the railroad company concluded that the coal fields to be served lacked sufficiently extensive markets to counterbalance the continual menace to the road from floods.

This branch will open up one of the largest and richest coal fields of the West.

Virginia Anthracite Properties Leased

A syndicate is said to have leased for an indefinite period the properties of the Empire Anthracite Coal Corporation located 8 miles northwest of Pulaski, Va., and will take charge in October.

It is understood that the output of about 400 tons daily will be doubled, necessitating the employment of more men in all departments.

This is one of the few anthracite mining operations in Southwest Virginia, having been opened several years ago.

Rate Decisions Said to Prompt C. & O. Equipment Purchases

The decision of the Interstate Commerce Commission in the lake cargo coal case and the action of that body in establishing an all-rail rate on coal to New England are regarded by shippers as having much to do with the fact that the Chesapeake & Ohio has arranged for the purchase of equipment aggregating $8,000,000. The understanding is that the bulk of the new equipment will be used for coal haulage.

Virginian Railway Denied Injunction

The injunction sought by the Virginian Railway to restrain the Interstate Commerce Commission from compelling it to put into effect through western freight rates on shipments by way of the Chesapeake & Ohio was denied September 19 by a special court at Richmond, Va.

The Virginian, applying for the injunction, set forth that it desired to establish through western rates on coal by way of the Norfolk & Western.

The order of the commission was to have become effective June 25. It was sought by West Virginia coal operators and shippers, who claimed the Chesapeake & Ohio route would afford them better facilities.

After the decision the Virginian sought an interlocutory injunction, pending appeal.

Rock Dusting Gaining Headway

The rock-dusting of coal mines to prevent dust explosions or to limit their intensity has within the past year made a tremendous advance in the country at large and in Pennsylvania particularly. A year ago there were only four mines in Pensylvania that had been subjected to treatment by this method; now there are 62, with others soon to be treated.

Coke From Low Grade Coal and Lignite

The Iron and Steel Works of Prague, Czechoslavakia, is reported to have made successful tests of a method for making coke from low grade coal with equipment supplied by the German Kruppe, according to advices to the Commerce Department. Previously it has been impossible to make coke from the coal found in the region where the above firm is located, owing to the fact that the coal crumbled to dust during the coking process. The new method is said to make possible the production of coke from low grade coal and also from lignite.

Court Bars United Mine Officers

The United Mine Workers officials who have been touring the Logan field in West Virginia were recently served with a perpetual injunction at Logan against any attempts to organize the miners in that district, granted by Judge Bland in the Circuit Court of Mingo County. The injunction was applied for by 65 coal concerns in the Logan field. This is said to spell doom to the last effort of the union to organize in the Logan field.

Fayette County Coal Mines Handicapped By Court's Drainage Decision

The action of the Supreme Court of Pennsylvania in reversing a decision of a lower court will render difficult the operation of coal mines in the Indian Creek Valley, Fayette County, Pa., by restraining coal companies from discharging mine waste into Indian Creek at points where this contamination would be carried into reservoirs of water companies serving domestic consumers. As a result coal mining operations in this region are suspended for the time being at least. A period of six months, allowed the coal interests to comply with the court's decree, expired recently.

The defendants in the case, which was instituted some six years ago, are a score or more coal companies and individuals, the largest of these being the Melcroft, the Sagamore and the Indian Creek Coal & Coke companies.

The defendants have not been lax, however, in seeking a solution to the polution problem. For some time a series of engineering and scientific investigations in an effort to dispose of the mine waste have been under way, but so far nothing feasible has been developed.

Being entirely an intra-state litigation and not involving interstate commerce, the United States Supreme Court held that the decision of the state supreme court was not subject to review.

Further action on the part of the coal companies has not yet been decided upon.

Investigates Market Here For English Coal

Theodore Instone, British coal operator, is in this country to investigate inquiries regarding substitutes made to him by Americans. He said English anthracite operators, if required, could deliver 100,000 tons of coal monthly. He is also said to be interested in a substitute known as coke nuts for furnaces, which have been used successfully in Scandinavian countries in place of anthracite.

Russians Here to Place Orders For Mining Machinery

A delegation representing the combined coal mining industries of the Donetz Basin in Soviet Ukraine, known as the Trust Donugol, was in this country recently to place orders for mining equipment. Prior to placing orders a study of coal mines and mining equipment works in the United States was planned with a view to determining the types of equipment best adaptable to the industries of the Donetz Basin. The Donetz Basin is the chief source of hard mineral fuel in the Soviet Union, and it furnishes about 75 percent of the total coal output.

Miners Strike in Protest to Passenger Fare Increase

Miners in the Clinton fields of Indiana went out on a strike recently, in protest to an increase in fares charged by the Chicago & Eastern Illinois Railroad on a work train operating between Clinton, Ind., and the mines. Information received indirectly from John L. Lewis by local union officials was to the effect that such a strike is in violation of the existing contract, and it is reported that this point was stressed by Phil A. Penna, secretary of the Indiana Bituminous Coal Operators' Association, in a communication to Mr. Lewis.

A petition has been filed with the Indiana Public Service Commission by the miners asking that a rehearing be granted in the case.

Court Makes Miners' Injunction Permanent

Pomeroy, Ohio, judge has made permanent the temporary injunction granted the Pittsburgh Coal Company and the Statler-Essex Company, preventing striking miners from picketing mines of the companies or others operating on new wage agreements.

The Pittsburgh Coal Company is preparing to reopen, under the 1917 scale, the big Worden mine where recently it completed the assembling of the openings of five mines into the one opening of the Worden.

Eureka mine, of the Bertha Consumers Company, one of the largest coal-producing mines in Northern West Virginia and the largest union mine in this section, has left the United Mine Workers and is operating under the 1917 scale.

Mining Companies Adopt Group Insurance

An addition to the ranks of large mining operators who are providing protection for their employes is the Kershaw Mining Co., of Birmingham, Ala., who have adopted a group insurance policy through an arrangement with the Prudential Insurance Co., whereby the 54 workers on the pay roll receive, without cost to them, coverage amounting to $77,000.

Those employes who earn up to $100 monthly have received certificates of protection for $1,000. Those who receive from $100 to $150 are eligible to $2,000, and those whose wages exceed $150 have protection of $3,000.

Because of the large number of employes covered, no medical examination was required by the Prudential, and all workers, regardless of age, are included in the policy.

The Delmar Coal Company, of Fairmont, W. Va., has taken out contracts with the Metropolitan Life Insurance Company which provide for its employes group life insurance totaling approximately $115,000, in addition to health and nonoccupational accident benefits.

The policies were written on cooperative bases, the employes sharing the cost of the insurance with the employer. About 115 workers are protected under the contracts.

Advisory Committee Making Study of Bureau of Mines Work

The second meeting of the committee, advisory to Secretary Hoover in the matter of the transfer to the Commerce Department of the Bureau of Mines, was held early in September in Salt Lake City.

The committee is to make an intensive study of the various phases of the Bureau's work. Sub-committees were appointed for the consideration and formulation of recommendations covering the studies assigned to each, and reports will be made at the next meeting, which will be held at the Pittsburgh station of the Bureau some time in October, following which it is planned that recommendations will be made to Secretary Hoover.

Department of Commerce Metals Investigations

William Chattin Wetherill, of the Department of Mechnical Engineering, University of Pennsylvania, has been appointed director of the Department of Commerce Investigations into the utilization of metals, introduction of simplified practice and elimination of waste in metal-using industries.

The most important metals to be taken up are iron, copper, tin, lead and zinc. The Department, through the Bureau of Standards, Simplified Practice, Iron and Steel, Machinery, and Specialties divisions, has brought about important developments in improving methods and processes, and in the development of domestic and foreign markets.

High prices of imported metals and foreign trade combinations make the investigations important to metal-using industries. Substitution of cheaper and more easily derived metals for those which are now adding to manufacturing costs will be considered, as will also relative wearing qualities and replacements of metals.

Mr. Wetherill is well known in engineering and industrial circles. He was formerly connected with the Link Belt Engineering Company, the Wetherill Finished Castings Company and the Keystone Screw Company.

Rumor Ford Will Build Big Smelter in Montana

Rumors from Butte, Mont., are to the effect that new claims taken up on the west side of the Butte district are in the interest of the Ford Motor Company. An unconfirmed report states that it is Ford's plan to erect a large smelter on the property acquired for the treatment of lead and iron ores from Montana and Idaho. The story is that a $5,000,000 structure, with the most modern equipment, is contemplated.

Abandon Plans for Electrolytic Zinc Plant at Kellogg, Idaho

For several months there has been agitation for the erection of an electrolytic zinc plant by the Bunker Hill & Sullivan Mining & Smelting Co. at Kellogg, Idaho, but it is said that a decision has been reached that such an undertaking is not advisable. The fact that Belgian and French, as well as English, interests are contracting for zinc ore shipments at cheap rates via the Panama Canal, and the Anaconda Company is in the market for zinc to supply the addition to its plant, rather discouraged the movement of the Idaho people as a profitable investment.

Anaconda to Enlarge Plant

The Anaconda Copper Mining Company has announced that the extensions to the Great Falls plant of the company will increase its capacity about one-third. The new zinc plant should be in full operation early in 1926 and the new copper plant by the end of that year. The production of the combined plants in the East and West will then total, it is said, approximately 46,000,000 pounds a month, the largest known output in the world.

Expects Increase In Demand For Zinc

The market prospects for zinc are favorable from the producers' viewpoint for the fourth quarter, according to A. J. M. Sharpe, of the International Metal Service. In the case of Europe, according to Mr. Sharpe, the dwindling output

forecast earlier in the year is coming to pass, and in the face of a steady expansion in consumption a shortage of metal is developing. It is expected that, irrespective of price, European importers will be forced to buy American zinc on a large scale during the rest of the year.

Homestake Buys Idaho Properties for $1,000,000

It has been announced that negotiations have been completed for the purchase by the Homestake Mining Company, of Lead, S. Dak., of the Meadow Creek and the Antimony groups of mining claims in the Yellow Pine Basin, central Idaho, for $1,000,000. These groups represent the largest deal in many years in Idaho, and the sale is taken to indicate that mining in the state is on the way to development on a large scale.

Prospectors Financed by Boulder Business Men Are Showing Results

A highly optimistic report was presented at a recent meeting of the Boulder Grubstake Association, an organization of business men recently formed for the purpose of placing prospectors in the hills around Boulder, Colo. There are at present nine men under contract with the Association, each one of them experienced in prospecting and devoting his work to the exploration of proven fields. A recent inspection showed four of these men working on pay ore, with good prospect that their enterprise would soon be self-supporting. The others, who are later in the field, have not yet gotten their work lined out to definite results.

The Grubstake Association has only been organized four months and only had men out for three months.

The Association will become one-fourth owners of any ore bodies uncovered by the prospectors.

Federal Purchases Wallace Mountain Mines

The Federal Mining & Smelting Co., subsidiary of the Guggenheim interests, has purchased the Wallace Mountain Mines (Ltd.), consisting principally of the Sally mine, at Beaverdell, B. C. Through the Sally they will develop some dozen claims on which options to purchase have already been taken. They also plan a concentrator, the first in the district.

A. S. & R. Plants At Capacity

Plants of the American Smelting & Refining Company in Mexico and the United States are at capacity, ample labor is available and expansions are producing the expected improvement in results. This report was brought back by E. L. Newhouse, chairman; F. H. Brownell, first vice president, and William Loeb, vice-president, who have just returned from their annual inspection in both countries.

Aluminum Company Will Manufacture Metal Furniture

The Aluminum Company of America plans to compete in the metal furniture field. Production has been started at the Buffalo plant. Their output at first will be confined to office furniture of all-aluminum construction. Officials believe that a scale of prices sufficiently close to metal furniture can be established to make the product attractive. Lightness of aluminum, it is claimed, will make substantial savings in freight and handling costs, an especially attractive feature from the standpoint of dealers.

Concentration of Fluorspar Ores

An investigation to determine possible improvements in the milling of fluorspar is being conducted at Rolla, Mo., by the Bureau of Mines, Department of Commerce. A study has been made of tailings from concentrating mills in southern Illinois, and the material was subjected to experimental classification, and concentration with jigs and tables in order to determine its behavior. Sufficient progress has been made to indicate that considerable improvement in concentration and more economical recovery may be effected.

Clark Memorial Clubhouse

Plans have been completed for the construction of a $90,000 community clubhouse at the smelter town of Clarkdale, Ariz. The building, which is to be erected from a fund of $100,000 bequeathed to Clarkdale by the late Senator William A. Clark, will be known as the "Clark Memorial Community Clubhouse."

Douglas Smelter Construction

Men are now at work on preliminary dismantling and evacuation work at the Douglas smelter of the Copper Queen Branch, Phelps-Dodge Corporation. This is the initial work on the one and a half million dollar construction project which will be carried on during the next year and a half.

President, Michigan College of Mines

W. O. Hotchkiss has accepted the election and will assume office immediately as president of the Michigan College of Mines. He succeeds the late Dr. F. W. McNair, who was killed in a railroad accident. Mr. Hotchkiss has been state geologist of Wisconsin since 1909, and is an engineer, geologist and author of international repute.

Germans Develop New Carbon Steel

A dispatch from Berlin announces the discovery of a new carbon steel which is said to be 40 percent lighter than steel now generally used in construction purposes. Laboratory tests reveal a smoother surface and more tensile strength than ordinary crucible steel and exceptional degrees of thinness in walls and castings on the new product, which is said to be particularly useful in the manufacture of automobiles and railway rolling stocks. Production cost is 10 percent more than ordinary steel, but superior powers are estimated to effect economy of nearly 40 percent, or a saving of nearly 30 percent.

Predicts Electrification of Steel Industry In Next Ten Years

At the twenty-eighth annual convention of the Association of Iron and Steel Electrical Engineers in Philadelphia, John A. Oartel, chief of the safety bureau of the Carnegie Steel Company, pointed out to more than 200 electrical engineers from all the leading mills in the steel districts that the progress made in the electrification of steel plants would indicate that, in the course of the next 10 years, virtually the whole industry would be electrified.

Metallurgy of Cast Iron

Several important papers on the metallurgy of cast iron have been prepared for presentation at the cast iron sessions of the American Foundrymen's Association convention to be held October 5 to 9, at Syracuse, N. Y.

Synthetic cast iron as produced in the electric furnace, a topic of especial importance to Pacific Coast foundrymen, will be discussed by G. E. Lamb, of Hoquiam, Wash., and G. S. Schaller, of Seattle.

Extensive heat treatment of cast iron and semi-steel research results to check up previous experiments by other investigators will be discussed by O. W. Potter, of the University of Minnesota.

The effects produced by additions of nickel and nickel chromium on cast iron properties will be explained in a paper to be presented by T. H. Wickenden and J. S. Vanick. The points covered in this paper are tensile strength, transverse strength, deflection, machinability, chilling, shrinkage, fluidity and hardness.

The effect of oxygen on coke and charcoal cast iron will be the subject of a paper by J. R. Eckman and Louis Jordon, of the Bureau of Standards, and W. E. Jominy, of the University of Michigan.

J. T. MacKensie will report on a series of investigations on the effects of phosphorus in cast iron.

J. L. Jones Named Director of American Foundrymen's Association

Jesse L. Jones, in charge of the chemical and experimental laboratory of the Westinghouse Electric & Manufacturing Co., has been named a director of

the American Foundrymen's Association and also appointed as chairman of the important Grey Iron Castings Committee. He is also a member of the building and equipment section of their General Foundries Committee, which is just now busy with the erection of a new half-million dollar brass foundry.

Papers Upset Steel Hardening Theories

Two papers which, scientists say, will give metallurgists more to think about in the coming year than any theories advanced during this convention were presented to the American Society for Steel Treating at Cleveland, says the Associated Press.

One by Dr. J. A. Matthews, New York, upsets the old theory on how to harden steel so that it will retain magnetism for a longer period. The other, prepared by Dr. H. Hanemann, of the Technischen Hochschule, Germany, was a presentation of changes which occur during the quenching, or cooling of steel, and a method of diagramming these changes.

The slow quenching of steel in oil produces a condition which causes the metal to retain magnetism for a longer period, Dr. Matthews said. Heretofore practice was based on the theory that the harder the steel the longer it held the magnetism charge. Rapid water quenching hardens steel and has been the accepted method. Many scientists showed an unwillingness to accept the two radical innovations without further proof.

The annual sectional meetings will be held at Buffalo in January, and Hartford, Conn., in June. Next year's convention will be held in Chicago.

Metal Trades Labor Barometer Rises

Employment in 840 metal working shops reporting to the National Metal Trades Association, Chicago, showed an increase in July over June. June showed the first decrease of the year. The shops reporting to the association are located in New England, New York, Pennsylvania, Ohio, Indiana, Michigan, Wisconsin, Illinois, Iowa and Missouri and had an enrollment of 588,782 employes in July, as compared with 584,965 in June, 590,210 in May, 589,372 in April, and 576,533 in March. The same shops reported 519,997 employes in June, 1924.

Pig Iron and Magnesite Investigation Suspended

The Tariff Commission has temporarily suspended its investigations as to the cost of production of pig iron and magnesite in the United States and foreign countries. The pig iron inquiry was authorized in March, 1923, and that as to magnesite in August of that year. Postponement of the pig iron inquiry is said to be based on the inability and undesirability of ascertaining production costs due to their fluctuation.

"Story of Steel," Moving Picture

Representatives of the U. S. Steel Corporation, in collaboration with subsidiary companies, have for the past two years been engaged in making moving pictures for place in a new "Story of Steel." These include all practices of iron mining and all processes at the plants of the Minnesota Steel Company in Duluth, and operations of the ore transportation companies.

To Strip at Sultana-Hopkins

Clement K. Quinn & Co., of Duluth, are preparing to strip the Sultana-Hopkins iron mine, on the Cuyuna range, an area of 120 acres. The depth of the overburden averages about 52 feet, and is estimated at 1,500,000 cubic yards. Both the Sultana and the Hopkins are producers of manganiferous iron ore of excellent quality. The decision to strip the properties was made after a comprehensive exploration with four drills.

Inland Steel Takes Over Morton Mine

The Morton mine, at Hibbing, Minn., formerly operated as an underground mine by the Todd-Stambaugh Co., was recently taken over by the Inland Steel Company. It has been inactive since 1922. Since it was opened in 1912 more than 200,000 tons have been mined, and the tonnage yet available exceeds 2,000,000. The Inland Steel Company will prepare it for active operation.

Gogebic Shipments 17 Percent Ahead of Last Year

Shipping of ore on the Gogebic range, Michigan, has been going on at a better rate than early in the season, when many mines curtailed operations. Actual mining operations have not been increased to any great extent, but the deficiency in daily hoist has been made up from stockpiles. Shipments so far this season have been about 17 percent greater than those of last year, more than three and a half million tons having been shipped from this Michigan range up to the middle of August.

North America and Peru Silver Production

Silver production in North America and Peru for the eight months ended August 31 totaled 124,427,683 fine ounces against 125,436,014 in the 1924 period, according to the American Bureau of Metal Statistics. Production in the United States totaled 42,033,041 ounces, against 41,768,660 last year. Canada produced 9,841,664 ounces, against 11,657,512 in the previous year. Mexico's output was 59,578,609 ounces, against 69,279,842 in this period in 1924, and Peru's production was 12,974,000, against 12,730,000 ounces for the first eight months of last year.

Guggenheim Bros. Acquire Tin Property In Bolivia

Guggenheim Brothers have acquired a tin dredging property in Bolivia of considerable size and will equip it with modern dredges and a hydro-electric power plant. Engineers acting for the firm spent six months in a thorough investigation and their reports indicate easy operating conditions.

Canada's Mine Output Larger

Substantial advances among the metals characterized the mineral production records for Canada during the first half of 1925, according to a statement issued by the Dominion Bureau of Statistics. Production of metals and non-metals reached a total value of $90,347,698, as compared with $84,307,385 in the first half of 1924, an increase of 7.16 percent.

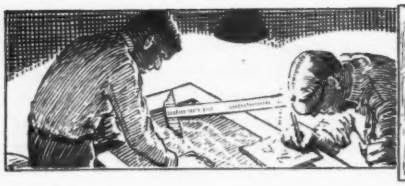
Advances among the metals were general. Gold rose to a new record. Lead advanced 62.41 percent over the high mark attained in the first half of 1924. Nickel production was well maintained. Copper was up 1,000,000 pounds. Silver showed increased values. Zinc followed the trend in lead to almost double the output recorded in the first half of 1924. Cobalt production continued to improve.

Oil Fields Found in Arctic Alaska

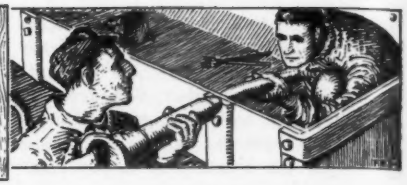
Discovery of oil in the Arctic slope of Alaska was reported by Gerald Fitzgerald, head of a United States Geological Survey party that this summer visited the valleys of the Colville and Noatak rivers, when he returned from the North. Mr. Fitzgerald, who headed a party of four, left Washington, D. C., in March.

"Oil exists in the Point Barrow district, and if it is developed economically it will probably be on a large scale," he said. "We mapped geographically and topographically 7,000 square miles of wholly unexplored country. One of the purposes of the expedition was to determine the extent of the oil area. This we accomplished."

Adoption of the American import value system would eliminate the ill feeling evidenced by foreign manufacturers and their governments toward the activities of the Treasury Department in seeking from the books of exporters abroad data upon which to base the dutiable value of merchandise offered for entry into the United States, according to the American Protective Tariff League.



WITH THE MANUFACTURERS



Develop New Reflector

A new reflector that is as efficient as a freshly silvered glass mirror, that will not tarnish or corrode when exposed continually to the weather, and so hard that the surface can be cleaned with gritty waste without scratching, was described by Dr. Robert J. Piersol, research physicist of the Westinghouse Electric & Manufacturing Company, in a paper read before the Illuminating Engineering Society meeting at Detroit, September 15 to 18.

The new reflector has a surface of polished chromium, and was developed by Dr. Piersol in his search for one that would be satisfactory for use on automobile headlights and outdoor flood lights.

Glass backed with a silver coating, now the best reflector of light in common use, is not practical for these two purposes, as it is extremely fragile and the cost of its manufacture in the larger sizes is prohibitive. For automobile headlights, a popular reflector has been silver or nickel, plated on a smooth surface such as copper and given a high polish. The silver must be coated with a thin layer of lacquer to protect it from the weather, which reduces its reflecting qualities and quickly turns dark, and while nickel does not corrode under atmospheric conditions as rapidly as silver, its reflecting properties are not high.

Aluminum and its alloys, and other metals, have been tried, but they are of even less value, as a reflector, than nickel.

Although chromium is one of the most brittle metals known, it is very ductile when plated as a thin coat. This is shown by bending a strip of chromium plated copper repeatedly. The strip may also be heated to a red temperature and quenched in water without the chromium plate scaling from the copper base.

The surface of the chromium plate is of tool steel hardness and it is difficult to scratch it with a pin or knife. In fact, it is possible to wipe the dust from a chromium plated reflector with gritty waste without injury to the polish of the reflector. Ordinary emery grinding compounds would not touch chromium plate and therefore it was necessary to develop a new grinding and polishing compound.

The reflectivity of chromium is selective to about the same extent as silver. The coefficient of reflection is initially high and remains high throughout an accelerated life test.

Chromium is not subject to corrosion from sulphur fumes on water vapor, causes of tarnishing in silver. Chromium is only attacked by chlorine fumes which are very rare in the atmosphere.

New Motor-Circuit Switch

The CR-1049 manual contactor recently placed on the market by the General Electric Company is a new motor-circuit switch for easily disconnecting both motor and control from the line under practically all conditions except a dead short circuit. It consists of contact elements mounted on insulated shafts and connected through a snap-action mechanism to the operating handle on the outside of a sheet-steel enclosing case.

Both case and handle can be locked in the open position, thus preventing unauthorized persons from closing the device. No provision is made for locking the handle in the closed position, since the contactor will open the load with full safety to the operator. Silver contact tips are used on all sizes with the exception of the 50-ampere, thus cutting down the contact resistance.

The new contactor is being made in four sizes, as follows: CR-1049-B2, 50 amperes, 3 poles; CR-1049-B2, 80 amperes, 2, 3, and 4 poles; CR-1049-C1, 150 amperes, 2, 3, and 4 poles; CR-1049-D1, 300 amperes, 2 and 3 poles.

In designing the enclosing cases, consideration was given to space required for making soldered connections, to aid those who will install these contactors.

The Improved Timken Bearing

An improved type of Timken tapered roller bearing, differing from the well-known Timken bearing in major refinements but retaining all essential elements, which have characterized Timken tapered design, is now in production.

Nickel-molybdenum steel, of special Timken formula has been adopted for all bearings. The inclusion of the alloys, nickel and molybdenum, produce a steel possessing properties of grain texture, toughness, hardening, heat treating and machining which reflect favorably in the life of anti-friction bearings.

The design of the roll has been changed so that the surface of the large end presents a right angle relation to the center line of the roll. The contact then between the large end of the roll and the rib of the cone is in two areas, the rib of the cone being slightly undercut.

The Timken cage has been improved along with the cone and roller assembly. Previously, the cage was cold pressed into the shape of a cup, the bottom stamped out and the pockets for the rolls punched out, one at a time, by an automatic punch press. The result of this single stamping operation was positive uniformity of cage pockets, yet a progressive error in alignment, due to stretching of the metal, as the indexing fixture advanced the metal cage to the final perforation. To correct this microscopic error, a multiple perforating die was developed which perforates all roll pockets in the cage, by a single impact. To further safeguard against any possibility of error during this operation, due to distortion, an inwardly turned flange has been retained on the smaller side of the cage. To insure smoothness and a perfect fit of the rollers in the cage the lateral edges of the cage are swedged inward so that the contour of the sides of the cage pocket conform to the contour of the roll. This operation is termed "winging." Dies similar to the multiple perforator are used, so that all cage pockets are winged simultaneously.

New Design of Trolley Frog

Overlapping runners giving continuous wheel bearing to prevent trolley wheel jumping, bayonet approaches giving smooth underrun, sturdiness of construction and ease of installation are the outstanding features of a new design of trolley frog manufactured by the Westinghouse Electric and Manufacturing Co., according to a recent announcement by that company. They further say:

"During the past years most of the trolley frogs have been of the 'open pan' type in which the flanges of the trolley wheel ride on the pan of the frog. In attempting to overcome the difficulties encountered in the use of this type of frog many modifications of this design have come about. Some designs operated effectively for trolleys operating from tangent to curve, but failed when operating in the reverse direction, for the wheel invariably left the frog due to the use of a 15° angle.

"For perfect transition it was found that an 8° angle was the proper one, but due to the fact that in the cities the curves are of such short radius this

angle was not suitable. The result of considerable study by Westinghouse engineers was a frog which embodied a combination of the 8° and 12° angles permitting of perfect transition from tangent to curve and also from curve to tangent.

"One of the outstanding features of this new design is the fact that the wheel flanges do not touch the pan, thus giving it a longer life. Frequently frogs are located where the majority of cars take the tangent track, resulting in a groove being worn. In the old type of frog this resulted in ill effects due to the fact that the trolley, in running from tangent to curve, tended to follow the grooves while the car followed the curve. The result was that the wheel left the frog. The new design prevents such jumping.

"Flexible approaches are another important factor in the new design of frog. These approaches eliminate the hammer blow as the wheel approaches the body of the frog and does away with the old method of holding the frog by use of stove bolts. These bayonet approaches firmly hold the trolley wire and the sides of the approach interlock with the prongs on the runner providing a high safety of factor and ease of installation."

L. M. Zimmer has been appointed general sales manager of the Linde Air Products Company, manufacturers of oxygen, and of the welding gas division of The Prest-O-Lite Company, Inc., manufacturers of dissolved acetylene, succeeding L. M. Moyer, who resigned August 1, 1925.

Mr. Zimmer entered the employ of the Linde Company nine years ago as junior salesman, and has steadily risen in rank. Most of the time he has represented the company in the Central West, coming to New York early in 1924 to act as assistant general sales manager.

American Cable Company Appoints New Distributors

The American Cable Company has appointed the well known firm of Bruntons, Musselburgh, to handle its general line, including Tru-lay wire rope and Tru-loc fittings, in Scotland. The Dominion Wire Rope Company, Montreal, is a new Canadian distributor. Other new distributors are: The Marion Machine, Foundry & Supply Co., Marion, Ind.; J. Shuman Hower, 106 Foster Bldg., Utica, N. Y.; The Contractors Equipment Company, 8 Steuben St., Albany, N. Y., and John C. Louis, 221 S. Eutaw St., Baltimore, Md.

Mr. J. V. N. Dorr, president of the Dorr Company, arrived on the "Olympic" August 26, after spending two and a half months in Europe in connection with European business of the company.

A New and Important Explosive

Following many experiments both in the laboratory and in the field, the Hercules Powder Company has announced a new high explosive—Hercules Special No. 3. It is especially designed for underground mining where fumes are important and it is adapted for underground work in ore, shale, clay, gypsum, and, because of its non-staining qualities for use in salt mines.

Hercules Special No. 1 and Special No. 2 were two of the really important contributions of recent years to the blasting industries. Where these explosives are suitable, a 15 percent reduction of blasting costs by their use is not uncommon. They are most widely adapted to quarry and open-pit work.

The economy of Special No. 1 and Special No. 2 naturally appealed to underground miners, also. They are used successfully in some underground mines, but their fumes make them unsuitable for others.

The newly developed Hercules Special No. 3 has all the advantages of Special No. 1 and No. 2 with better fumes. It makes it possible to reduce costs underground to the same extent that Specials No. 1 and No. 2 reduce costs in the open.

Complete information on Hercules Special No. 3 can be obtained from any office of the Hercules Powder Company.

Explosions Shown in Motion Picture

A one-reel picture entitled "Letting Dynamite Do It," has just been made by the explosives department of E. I. du Pont de Nemours & Co., and can be had for distribution on application to the company. The scenes show the use of explosives in many lines of industry and under many conditions. Practically every part of the country has been combed for pictures showing the employment of dynamite, all of which are picturesque and many sensational. There are views of the use of dynamite in the lumber camps of the Pacific Northwest, where the explosive is used to cut off the tops of tall trees and break log jams; also scenes on the Mexican border where a small mountain is converted into railroad ballast through the employment of thousands of pounds of dynamite. Other scenes show how reefs were blasted away in a Florida harbor, building a swimming pool in the east, taking out concrete foundations in the midst of a great plant without so much as breaking a window, and demolishing in a few minutes a disused blast furnace many feet in height. There are also scenes of the use of explosives in building roads in the west, the unusual application of dynamite in chipping out figures on Stone Mountain where the great Confederate memorial is being built, and then the spectacular feat of completely demolishing an old stone intake in Lake Michigan at Chicago, which was a menace to navigation. This one-reel picture is the second volume issued by the du Pont Company showing the use of dynamite in various operations throughout the country.

Contract Received for Four Automatic Mining Substations

A contract for complete electrical equipment for four automatic mining substations has recently been received by the Westinghouse Electric and Manufacturing Company from the Pennsylvania Coal and Coke Company. Although the total power rating for the four stations is but 1100 kw., the stations are unusual in that the operation and control are entirely automatic. This contract represents the largest ever awarded for this class of equipment.

Three of the stations are for use on the above company's property at Ehrenfelt, Pa. One of the stations is for the automatic control of a 300 kw. motor generator set. Another will control a 200 kw. motor generator set, while the third will control 200 kw. sets. The fourth station, located at New Shaft, will control two 100 kw. motor generator sets.

New Portable Compressor Catalogue

The Sullivan Machinery Company announces the publication of a new catalogue and point out that the time and labor saving advantages of compressed air have achieved a tremendously wider appreciation during the past two or three years, with the modern development of the portable compressor, and its adaptation to many industries.

This catalogue shows two types of portable gasoline engine driven compressors. The two-cylinder vertical class WK-312 type, direct connected to a four-cylinder Buda engine, and the 220-foot four-cylinder V type, or opposed cylinder type compressor, class WK-314. This is also operated by a Buda 4-cylinder engine. Each of these compressors can be mounted on steel wheels for highway work, or on heavy rubber tired wheels, on a trailer truck with spring suspension and rubber tires for work in cities; or on skids, for mounting on a truck. The smaller machine is frequently mounted on a Ford one-ton truck giving extreme portability, for the use of city departments, public utility companies, etc. The Fordson-operated type,

class WK-34 and an electric motor driven type, Class WK-32, are also illustrated. Copies upon request to Sullivan Machinery Company, Chicago, Ill.

New Diamond Drill Catalogue

A new Diamond Drill Catalogue No. 80, has been issued by the **Sullivan Machinery Company**. This catalogue illustrates and describes their latest improved types of Sullivan Diamond Drills. This catalogue commemorates the 50th birthday of the Sullivan Diamond Drill. It includes not only the Standard types used for coal and hard mineral prospecting, and for engineers' test borings, but also some of the newer heavy duty types for oil field drilling, such as the C and CN, Fordson power plant mounted drill for shallow testing of geological structures, and the Class FK machine, capable of boring a 4-inch hole to 6,000 feet. With one of these machines, exploration was recently carried to a depth of 6,007 feet in India.

The book includes specimen lists of Diamond Drill Equipment, instructions for selecting an outfit, and a chapter on setting up and operating the machine, under ordinary field conditions. There is also a section on setting diamond bits. Copies upon request to Sullivan Machinery Company, 122 South Michigan Avenue, Chicago.

The Borden Company, Warren, Ohio, manufacturers of pipe cutters, have issued a folder descriptive of their new beaver power drive for cutting and threading pipe. This folder is known as the No. 44 and gives full information concerning this equipment, with illustrations and price schedules.

Ruggles-Cole Engineering Company, York, Pa., has ready for distribution a new bulletin, No. 22, descriptive of their drying equipment, illustrating, describing and classifying eight distinct types of Ruggles-Coles Dryers.

Warren-Knight Company, Philadelphia, Pa., manufacturers of "Sterling" surveying instruments, have issued a folder dealing with the model No. 4, Sterling transit, which is designed to especially assist builders and construction engineers. The folder gives full information concerning this special model, completely illustrated. It also describes the Sterling convertible levels. The model No. 4 transit will be sent on the Warren-Knight Company's free examination plan, and full information may be obtained from their home office together with a copy of folder "24 MC."

"Capacitors" is the title of a 24-page bulletin just issued by the **General Electric Company**, describing the value of this device in power factor correction on electric generating and distribution systems and for direct installation at motor terminals on low voltage circuits. Details are given as to operation, location, etc. Illustrations in the form of charts, diagrams, tables and photographs are used. The bulletin bears the designation GEA-77.

Hardinge Company, York, Pa., have issued a review bulletin, which calls attention to recent publications on the following subjects: Continuous Grinding, featuring Hardinge Conical Mill, Bulletin No. 13; Cylindrical and Conical Batch Mills—Bulletin No. 19; Rotary Air Classifier—Bulletin No. 17; Tube Mills—Bulletin No. 18; Rock Dusting of Coal Mines—Bulletin No. 21; Stone Screens—Bulletin No. 20; Pulverized Limestone—Bulletin No. 14; Metal Reclamation—Bulletin No. 8; Grinding Ceramic Materials—Bulletin No. 10.

Copies of any or all may be obtained from their offices at York, Pa., 120 Broadway, New York City, or Newhouse Building, Salt Lake City, Utah.

Stephens-Adamson Mfg. Company, Aurora, Ill., has issued a bulletin dealing largely with the new ore sampling plant of the Utah Ore Sampling Company, at Murray, Utah, which is fully illustrated with cuts of the equipment used. This publication also illustrates and describes the Sacon carrier, a new belt conveyor manufactured by them. Copies of this publication—the August issue of their "Labor Saver"—are available at their Aurora office.

UNDERGROUND MINE CAVING METHODS

(*Continued from page* 483)

swing from steam shoveling towards carving. When the ratio of waste to ore is high, and the initial cost of removing the overburden, cost of mechanical equipment, and deferred interest upon a steam shoveling investment, are considered, a decision in some cases would doubtless be favorable to caving methods. It will be conceded that an underground caving operation can usually be placed on a producing basis quicker than a steam shoveling operation, under the above conditions.

Since the acquisition of the properties of the Arizona Copper Company by the Phelps Dodge Corporation, it has become possible to change the mining methods from the relatively "High Cost Flat, and Inclined Top Slicing Methods" formerly used in the Humboldt Mine, to a modification of the "Inspiration Method," and in the heavier ground, to a method which we call the "Morenci Caving Method," the main new feature of which is that the ore is drawn from the stopes through timbered inclined drifts to the grizzlies, thus eliminating hand tramming in the stopes. These changes have been most successful, resulting in a much higher efficiency, and lower costs.

Also, at the Copper Queen Branch of the Corporation at Bisbee, in the East orebody, a similar operation has been started in a comparatively small neck or upper extension of this orebody, and if successful, the method will most likely be adopted in the main portion of this orebody later, as the ore is needed.

I believe that the future possibilities of caving methods of mining are greater than has been generally recognized, and in view of the fact that the selling price of copper has lagged behind so badly, as compared to the prices of steel, lead, etc., since the war, it is vitally necessary to the well being, and future prosperity of these companies that they adopt, wherever possible, mining methods which will return a maximum profit upon their investments.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912,

OF THE MINING CONGRESS JOURNAL, published monthly at Washington, D. C., for October 1, 1925.

City of Washington,
District of Columbia, ss:

Before me, a notary public in and for the state and county aforesaid, personally appeared R. S. Mowatt, who, having been duly sworn according to law, deposes and says that she is the assistant business manager of the MINING CONGRESS JOURNAL, and that the following is, to the best of her knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in Section 411, Postal Laws and Regulations, printed on the reverse side of this form, to wit:

1. That the names and addresses of the publisher, editor, and business managers are:

Name of publisher, The American Mining Congress; post-office address, Washington, D. C.

Editor in chief, J. F. Callbreath; editor, E. R. Coombes; business manager, E. C. Porter.

2. That the owners are (give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 percent or more of the total amount of stock): The American Mining Congress—a corporation, not for profit. No stockholders. L. S. Cates, president, P. O. Box 1775, Salt Lake City, Utah. Daniel B. Wentz, first vice-president, Land Title Building, Philadelphia, Pa. E. L. Doheny, second vice-president, Securities Building, Los Angeles, Calif. Wm. H. Lindsey, third vice-president, First National Bank Building, Nashville, Tenn. J. F. Callbreath, secretary, 841 Munsey Building, Washington, D. C.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are (if there are none, so state): None.

R. S. MOWATT,
Assistant Business Manager.

Sworn to and subscribed before me this 22d day of September, 1925.

[SEAL.] MARY V. JUDGE.

(My commission expires April 15, 1930.)

STONEGA COAL AND COKE RODA

Satisfied Customers

Admiralty Coal

New River Smokeless

If you have never used a General Coal, backed by General Coal Company's dependable service, you cannot appreciate the fact that it does make a difference where you get your fuel.

Eighty-five percent of our customers are "Old Timers" who return year after year knowing that they are buying increased power at decreased cost.

After all, the principal attribute of any business is satisfied customers. Your first order will result in a new name added to our long list of "regulars."

We will gladly furnish you with more information upon request.

DEPENDABLE COAL *Anthracite*

GENERAL COAL COMPANY

1727 Land Title Building

PHILADELPHIA

BUNKER COAL
Supplied at
Baltimore, Md.
Charleston, S. C.
Hampton Roads, Va.
Jacksonville, Fla.
New York
Philadelphia
Savannah, Ga.

BOSTON
CHARLESTON
CHARLOTTE
CINCINNATI

EXCLUSIVE SALES AGENT
—FOR—
STONEGA COKE AND COAL CO.
HAZLE BROOK COAL CO.
—AND—
SUCCESSOR TO BUSINESS OF
WENTZ COMPANY
—ALSO—
EXCLUSIVE WESTERN SALES AGENT
—FOR—
WESTMORELAND COAL CO.

DETROIT
NEW YORK
NORFOLK
PITTSBURGH

EXPORT & COASTWISE COAL
Loaded at
Baltimore, Md.
Charleston, S. C.
Hampton Roads, Va.
Philadelphia

THE LEHIGH COAL AND NAVIGATION COMPANY

Miners and Shippers

OLD COMPANY'S LEHIGH

For Over a Century

1820 **ANTHRACITE** **1925**

"The Best Since 1820"

437 CHESTNUT STREET - PHILADELPHIA, PENNSYLVANIA

BUYER'S DIRECTORY

ACETYLENE, Dissolved (Or in Cylinders)
Prest-O-Lite Co., Inc., 30 E. 42nd St., N. Y. C.

ACETYLENE GAS
Prest-O-Lite Co., 30 East 42nd St., New York City.

ACETYLENE GENERATING APPARATUS
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

ACID, SULPHURIC
Irvington Smelting & Refining Works, Irvington, N. J.

AERIAL TRAMWAYS
American Steel & Wire Co., Chicago and New York.

AIR COMPRESSORS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Ingersoll-Rand Co., 11 Broadway, New York City.

APPLIANCES, ENGINEERING
The Lunkenheimer Co., Cincinnati, Ohio.

AUTOMATIC CAR CAGES
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

AUTOMATIC FEEDERS, GRAVITY
G. M. Johnson Mfg. Co., Jeannette, Pa.

AUTOMATIC (Mine Doors, Truck and Electric Switches)
American Mine Door Co., Canton, Ohio.

AUTOMATIC SWITCH THROWERS
G. M. Johnson Mfg. Co., Jeannette, Pa.

AUTOMATIC WEIGHING MACHINES
Streeter-Amet Weighing & Recording Co., Chicago, Ill.

BATTERIES (Storage, Gas Welding, Cutting, Dissolved Acetylene)
Prest-O-Lite Co., 30 East 42nd St., New York City.

BATTERY SCREENS
Ludlow-Saylor Wire Co., 608 S. Newstead Ave., St. Louis, Mo.

BEARINGS (Roller)
Hyatt Roller Bearing Co., Harrison, N. J.

BELTING (Conveyor, Elevator, Transmission)
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

BELTING, SILENT CHAIN
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

BINS (Coke and Coal)
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

BIT SHARPENERS
Ingersoll-Rand Co., 11 Broadway, New York City.

BLACK DIAMONDS
R. S. Patrick, Sellwood Building, Duluth, Minn.

BLASTING POWDER
Hercules Powder Co., 934 King St., Wilmington, Del.

BLASTING SUPPLIES
du Pont Powder Co., The E. I., Wilmington, Del.
Hercules Powder Co., 934 King St., Wilmington, Del.

BLOWERS, CENTRIFUGAL
Ingersoll-Rand Co., 11 Broadway, New York City.

BLOWPIPES, Brazing, Carbon Burning, Cutting, Lead Burning, Welding, Welding and Cutting
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

BOILER MOUNTINGS
The Lunkenheimer Co., Cincinnati, Ohio.

BREAKERS (Construction and Machinery)
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Wilmot Engineering Co., Hazleton, Pa.

BUCKETS (Elevator)
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

CABLES
American Steel & Wire Co., Chicago and New York.

CABLES (Connectors and Guides)
American Mine Door Co., Canton, Ohio.

CABLEWAYS
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Lidgerwood Mfg. Co., 96 Liberty St., New York City.

CAGE (Safety Appliances)
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

CAGERS, AUTOMATIC
G. M. Johnson Mfg. Co., Jeannette, Pa.

CAGES
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
G. M. Johnson Mfg. Co., Jeannette, Pa.
Lidgerwood Mfg. Co., 96 Liberty St., New York City.
Traylor Engineering & Mfg. Co., Allentown, Pa.

CARBON AND BORTZ
R. S. Patrick, Sellwood Building, Duluth, Minn.

CARBON BURNING APPARATUS
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

CARBON RODS AND PASTE FOR WELDING
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

CAR HAULS
Jeffrey Mfg. Co., 958 N. 4th St., Columbus, O.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

CAR WHEEL BEARINGS
Hyatt Roller Bearing Co., Harrison, N. J.

CASTINGS
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CHAIN RAIL CAR HAULS
G. M. Johnson Mfg. Co., Jeannette, Pa.

CHAINS
Jeffrey Mfg. Co., Columbus, Ohio
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

CHAINS, AUTOMOBILE ENGINE
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

CHAINS, COAL CUTTING
Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CHAINS, DRIVE
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

CHAINS, FRONT END
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

CHAINS, OILING
Morse Chain Co., Ithaca, N. Y.

CHAINS, POWER TRANSMISSION
Jeffrey Mfg. Co., 958 N. 4th St., Columbus, O.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

CHAINS, SILENT (Rocker-Joint)
Morse Chain Co., Ithaca, N. Y.

CHAINS, SLING
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

CHAINS, SPROCKET WHEEL
Jeffrey Mfg. Co., 958 N. 4th St., Columbus, O.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

CHEMICALS
Roessler & Hasslacher Chemical Co., 709-717 Sixth Avenue, New York.

CHEMISTS
Hunt, Robt., Company, Insurance Exchange, Chicago, Ill.

CHILI MILL SCREENS
Ludlow-Saylor Wire Co., 608 S. Newstead Ave., St. Louis, Mo.

CLAMPS (Trolley)
Ohio Brass Co., Mansfield, Ohio.

CLUTCHES
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

COAL COMPANIES
General Coal Company, Land Title Bldg., Philadelphia, Pa.
Lehigh Coal & Navigation Co., Philadelphia, Pa.
Thorne, Neale & Co., Philadelphia, Pa.
Bertha-Consumers Company, Chamber of Commerce Bldg., Pittsburgh, Pa.

COAL CRUSHERS
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

COAL CUTTERS
Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.
Ingersoll-Rand Co., 11 Broadway, New York City.
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

COAL HANDLING MACHINERY
Jeffrey Mfg. Co., 958 N. Fourth St. Columbus, Ohio.
Lidgerwood Mfg. Co., 96 Liberty St., New York City.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

COAL LOADERS
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

COAL MINING MACHINERY
Goodman Mfg Co., Halsted St. and 48th Pl., Chicago, Ill.
Ingersoll-Rand Co., 11 Broadway, New York City.
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

COAL MINING PLANTS
Ingersoll-Rand Co., 11 Broadway, New York City.
Jeffrey Mfg. Co., 958 N. 4th St., Columbus, O.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

COAL SCREENS
Ludlow-Saylor Wire Co., 608 S. Newstead Ave., St. Louis, Mo.

COCKS (Locomotive, Cylinder and Gauge)
The Lunkenheimer Co., Cincinnati, Ohio.

COKE SCREENS
Ludlow-Saylor Wire Co., 608 S. Newstead Ave., St. Louis, Mo.

COMPRESSORS, AIR
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Ingersoll-Rand Co., 11 Broadway, New York City.

COMPRESSORS, MINE CAR
Ingersoll-Rand Co., 11 Broadway, New York City.

CONCENTRATING PLANTS
Traylor Engineering & Mfg. Co., Allentown, Pa.

You don't find sleeping porches on theaters

THE ARCHITECT selects only things needed by a theater and combines them artistically to meet his client's special case.

So, too, Linde Consulting Engineers meet an industry's needs by combining a knowledge of manufacturing problems with an intimate knowledge of the oxy-acetylene process. Both are needed to make the oxy-acetylene process fit smoothly into your business and become an economical part of your production.

Consulting Engineers in mining

In mining there are many possible applications of the oxy-acetylene process. Some of them are known to your welders and others can be explained and demonstrated by the Linde service men. The most important applications, however, can become available to you only when engineered into your business by men who understand your production problems and the oxy-acetylene process as well.

Linde engineers are a part of Linde Process Service which is free to Linde users for the asking.

THE LINDE AIR PRODUCTS CO.

General Offices:
Carbide and Carbon Building, 30 E. 42d Street
New York, N.Y.

37 Plants *22 District Sales Offices* *91 Warehouses*

LINDE OXYGEN

YOU CAN DEPEND ON THE LINDE COMPANY

CONCENTRATORS (Table)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

CONCRETE REINFORCEMENT
American Steel & Wire Co., Chicago and New York

CONDENSERS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Ingersoll-Rand Co., 11 Broadway, New York City.

CONTROLLERS
Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

CONVERTORS, COPPER
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Traylor Engineering & Mfg. Co., Allentown, Pa.

CONVEYOR BEARINGS
Hyatt Roller Bearing Co., Harrison, N. J.

CONVEYORS
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CONVEYORS, BELT
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

CONVEYORS, CHAIN FLIGHT
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.
Wilmot Engineering Co., Hasleton, Pa.

CONVEYORS, COAL
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Lidgerwood Mfg. Co., 96 Liberty St., New York City.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

CONVEYORS AND ELEVATORS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

CONVEYORS, PAN OR APRON
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CONVEYORS, SCREW
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

CORE DRILLING
H. R. Ameling Prospecting Co., Rolla, Mo.
Hoffman Bros., Punxsutawney, Pa.

COUPLINGS, FLEXIBLE
Fawcus Machine Co., Pittsburgh, Pa.

CROSSINGS AND CROSSOVERS
Central Frog & Switch Co., Cincinnati, Ohio.

CRUSHER SCREENS
Ludlow-Saylor Wire Co., 608 S. Newstead Ave., St. Louis, Mo.

CRUSHERS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.

CRUSHERS, COAL
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

CRUSHERS, JAW
Traylor Engineering & Mfg. Co., Allentown, Pa.

CRUSHERS (Gyratory)
Traylor Engineering & Mfg. Co., Allentown, Pa.

CRUSHERS, SINGLE & DOUBLE ROLL
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CRUSHING PLANTS, COKE
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CUTTING APPARATUS, Oxy-Acetylene, Oxy-Hydrogen
Oxweld Acetylene Co., 30 E. 42nd St., New York City.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

CYANIDE
American Cyanamid Co., New York, N. Y.
Roessler and Hasslacher Chemical Company, 709 Sixth Avenue, New York City.

CYANIDE PLANTS
Traylor Engineering & Mfg. Co., Allentown, Pa.

DECARBONIZING APPARATUS
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

DESIGNERS OF PLANTS
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

DIAMOND CORE DRILL CONTRACTING
H. R. Ameling Prospecting Co., Rolla, Mo.
Hoffman Bros., Punxsutawney, Pa.

DIAMOND DRILLING CARBON
R. S. Patrick, Sellwood Building, Duluth, Minn.

DIAMONDS, BLACK (See Carbon and Bortz)
R. S. Patrick, Sellwood Building, Duluth, Minn.

DOORS, AUTOMATIC MINE
American Mine Door Co., Canton, Ohio.

DOUBLE CRIMPED WIRE SCREENS
Ludlow-Saylor Wire Co., 608 S. Newstead Ave., St. Louis, Mo.

DREDGES, GOLD AND TIN
New York Engineering Co., 2 Rector St., New York City.

DRIFTERS, DRILL
Ingersoll-Rand Co., 11 Broadway, New York City.

DRILLING, DIAMONDS FOR
R. S. Patrick, Sellwood Building, Duluth, Minn.

DRILLS, AIR AND STEAM
Ingersoll-Rand Co., 11 Broadway, New York City.

DRILLS (Blast Hole)
Ingersoll-Rand Co., 11 Broadway, New York City.

DRILLS, CORE
H. R. Ameling Prospecting Co., Rolla, Mo.
Hoffman Bros., Punxsutawney, Pa.
Ingersoll-Rand Co., 11 Broadway, New York City.
Keystone Churn Drill Co., Beaver Falls, Pa.

DRILLS, ELECTRIC
General Electric Co., Schenectady, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York City.
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.

DRILLS, HAMMER
Ingersoll-Rand Co., 11 Broadway, New York City.

DRILLS (Hand Operated Coal)
Ohio Brass Co., Mansfield, Ohio.

DRILLS, PNEUMATIC
Ingersoll-Rand Co., 11 Broadway, New York City.

DRILLS, PROSPECTING
H. R. Ameling Prospecting Co., Rolla, Mo.
Hoffman Bros., Punxsutawney, Pa.
Ingersoll-Rand Co., 11 Broadway, New York City.
Keystone Churn Drill Co., Beaver Falls, Pa.
New York Engineering Co., 2 Rector St., New York City.

DRILLS, ROCK
General Electric Co., Schenectady, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York City.
Jeffrey Mfg. Co., 958 N. 4th St., Columbus, O.

DRILL STEEL SHARPENERS
Ingersoll-Rand Co., 11 Broadway, New York City.

DRIVES, SILENT CHAIN
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

DRUMS (Hoisting, Haulage)
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

DRYERS
Traylor Engineering & Mfg. Co., Allentown, Pa.

DUMP CARS
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

DYNAMITE
du Pont Powder Co., The E. I., Wilmington, Del.
Hercules Powder Co., 934 King St., Wilmington, Del.

DYNAMOS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Goodman Mfg. Co., Forty-eighth Place and Halsted St., Chicago, Ill.

ELECTRICAL APPARATUS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.

ELECTRICALLY OPERATED VALVE
The Lunkenheimer Co., Cincinnati, Ohio.

ELECTRIC HOISTING MACHINERY
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.

ELECTRIC LOCOMOTIVES
General Electric Co., Schenectady, N. Y.
Goodman Mfg. Co., Forty-eighth Place and Halsted St., Chicago, Ill.
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Ohio Brass Co., Mansfield, Ohio.

ELECTRIC MINE SUPPLIES
General Electric Co., Schenectady, N. Y.
Ohio Brass Co., Mansfield, Ohio.

ELECTRIC WIRES AND CABLES
American Steel & Wire Co., Chicago and New York.

ELECTRICAL SUPPLIES
General Electric Co., Schenectady, N. Y.

ELEVATORS
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Traylor Engineering & Mfg. Co., Allentown, Pa.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

ELEVATORS, BUCKET
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

ELEVATOR MACHINERY
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

ENGINE TRIMMINGS
The Lunkenheimer Co., Cincinnati, Ohio.

ENGINEERING APPLIANCES
The Lunkenheimer Co., Cincinnati, Ohio.

ENGINES
Lidgerwood Mfg. Co., 96 Liberty St., New York City.

ENGINES, GAS AND GASOLINE
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Ingersoll-Rand Co., 11 Broadway, New York City.

ENGINES (Hoisting and Hauling)
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

ENGINES, OIL
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Ingersoll-Rand Co., 11 Broadway New York City.

ENGINES, STEAM
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Ingersoll-Rand Co., 11 Broadway, New York City.

ENGINEERS
H. R. Ameling Prospecting Co., Rolla, Mo.
Hunt, Robert Company, Insurance Exchange, Chicago, Ill.
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.

EXPLOSIVES
du Pont Powder Co., The E. I., Wilmington, Del.
Hercules Powder Co., 934 King St. Wilmington, Del.

FAN DRIVES
Fawcus Machine Co., Pittsburgh, Pa.

FANS, VENTILATING
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.

FEEDERS, ORE
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Traylor Engineering & Mfg. Co., Allentown, Pa.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

FILTER WIRE CLOTH
Ludlow-Saylor Wire Co., 608 S. Newstead Ave., St. Louis, Mo.

FLOTATION MACHINES
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

FLOTATION OILS
Hercules Powder Co., 934 King St., Wilmington, Del.

FLOW METERS
General Electric Co., Schenectady, N. Y.

FLUX, WELDING
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

FORGINGS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

FROGS AND SWITCHES
Central Frog & Switch Co., Cincinnati, Ohio.

FURNACES (Copper, Lead, Blast)
Traylor Engineering & Mfg. Co., Allentown, Pa.

FURNACES (Reverberatory)
Traylor Engineering & Mfg. Co., Allentown, Pa.

PATRICK CARBON

for Diamond Core Drilling

Our many years' success is founded on the Reliability of our grading the best carbon mined. This results in noticeable economy in drilling.

R. S. PATRICK

Duluth, Minnesota, U.S.A.

Cable Address, "Exploring" Duluth

O-B Products are always developed to establish the highest possible standard of performance—not to meet a price.

The O-B organization has consistently followed this policy for 36 years.

The Ohio Brass Company

Mansfield, Ohio

OUR heat-treating equipment includes nine oil and gas-fired furnaces, all governed by central pyrometer system which gives complete control and regulation; one gas and one electric furnace for special work; water, chemical, brine and oil quenching tanks; complete case hardening equipment; traveling cranes; annealing furnaces; sand blast equipment; and Shore scleroscope and Brinell hardness testing equipment. *For this reason we say that no one should be able to make better gears than Nuttall's.*

R.D.NUTTALL COMPANY

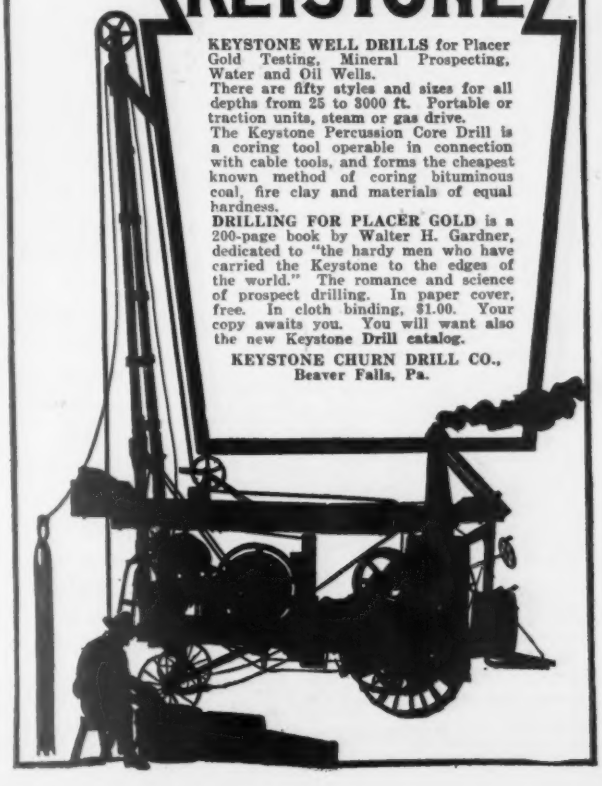
PITTSBURGH PENNSYLVANIA

Philadelphia Office
Westinghouse Bldg.
30th and Walnut Streets

Chicago Office
2123 Conway Bldg.

Canadian Agent:
LYMAN TUBE & SUPPLY COMPANY
Toronto—Montreal

KEYSTONE



KEYSTONE WELL DRILLS for Placer Gold Testing, Mineral Prospecting, Water and Oil Wells.
There are fifty styles and sizes for all depths from 25 to 3000 ft. Portable or traction units, steam or gas drive.
The Keystone Percussion Core Drill is a coring tool operable in connection with cable tools, and forms the cheapest known method of coring bituminous coal, fire clay and materials of equal hardness.
DRILLING FOR PLACER GOLD is a 200-page book by Walter H. Gardner, dedicated to "the hardy men who have carried the Keystone to the edges of the world." The romance and science of prospect drilling. In paper cover, free. In cloth binding, $1.00. Your copy awaits you. You will want also the new Keystone Drill catalog.

KEYSTONE CHURN DRILL CO.,
Beaver Falls, Pa.

FURNACES, ROASTING
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Traylor Engineering & Mfg. Co., Allentown, Pa.

GAS (Cutting, Welding) . .
Prest-O-Lite Co., Inc., 30 E. 42nd St., New York City.

GAS (Nitrogen, Oxygen)
Linde Air Products Co., 30 E. 42nd St., New York City.

GAUGES, WELDING
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

GEARS
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

GEARS, BEVEL
Fawcus Machine Co., Pittsburgh, Pa.

GEARS, HERRINGBONE
Fawcus Machine Co., Pittsburgh, Pa

GEARS, SILENT CHAIN
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

GEARS, SPUR
Fawcus Machine Co., Pittsburgh, Pa.

GEARS, WORM
Fawcus Machine Co., Pittsburgh, Pa.

GEARS, WORM WHEELS
Fawcus Machine Co., Pittsburgh, Pa.

GENERATORS AND GENERATING SETS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.

GENERATORS, ACETYLENE
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

GLOVES, ASBESTOS
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

GOGGLES, WELDING
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

HANGERS (Insulated Trolley)
Ohio Brass Co., Mansfield, Ohio.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

HEADLIGHTS, ARC AND INCANDESCENT
Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.
Ohio Brass Co., Mansfield, Ohio.

HERRINGBONE GEAR DRIVES
Fawcus Machine Co., Pittsburgh, Pa.

HOIST DRIVES
Fawcus Machine Co., Pittsburgh, Pa.

HOISTS
American Steel & Wire Co., Chicago and New York.

HOISTS, ELECTRIC
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Lidgerwood Mfg. Co., 96 Liberty St., New York City.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

HOISTS, PORTABLE
Ingersoll-Rand Co., 11 Broadway New York City.
Lidgerwood Mfg. Co., 96 Liberty St., New York City.

HOISTS, STEAM
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Ingersoll-Rand Co., 11 Broadway, New York City.
Lidgerwood Mfg. Co., 96 Liberty St., New York City.

HOISTS (Room and Gathering)
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Lidgerwood Mfg. Co., 96 Liberty St., New York City.

HOISTING ROPES
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

HOSE, AIR AND STEAM
Ingersoll-Rand Co., 11 Broadway, New York City.

HOSE, WELDING
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

INSULATORS, FEEDER WIRE
Ohio Brass Co., Mansfield, Ohio.

INSULATORS, SECTION
Ohio Brass Co., Mansfield, Ohio.

INSULATORS (Porcelain)
Ohio Brass Co., Mansfield, Ohio.

INSULATORS (Third Rail)
Ohio Brass Co., Mansfield, Ohio.

INSULATORS (Trolley)
General Electric Co., Schenectady, N. Y.
Ohio Brass Co., Mansfield, Ohio.

INSULATED WIRE AND CABLE
American Steel & Wire Co., Chicago, Ill.
Roebling Sons, John A., Trenton, N. J.

KILNS (Rotary)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

LAMPS, ARC AND INCANDESCENT
General Electric Co., Schenectady, N. Y.

LEAD BURNING APPARATUS, Oxy-Acetylene, Oxy-City Gas
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

LOADERS (Mine Car)
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

LOADERS, PORTABLE
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

LOADING BOOMS
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

LOADING MACHINES
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Jeffrey Mfg. Co., 938 N. 4th St., Columbus, O.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

LOCOMOTIVES, ELECTRIC
General Electric Co., Schenectady N. Y.
Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.

LOCOMOTIVES, RACK RAIL
Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.

LOCOMOTIVES, STORAGE BATTERY
Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.

MACHINERY, TRANSMISSION (Power)
Jeffrey Mfg. Co., 958 N. 4th St., Columbus, O.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

MANIFOLDS, OXYGEN
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

MILLS, ROD & BALL
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Traylor Engineering & Mfg. Co., Allentown, Pa.

MILLS, STAMP
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Traylor Engineering & Mfg. Co., Allentown, Pa.

MILLS (Tube)
Traylor Engineering & Mfg. Co., Allentown, Pa.

MINE CAR BEARINGS
Hyatt Roller Bearing Co., Harrison, N. J.

MINE DOORS, AUTOMATIC
American Mine Door Co., Canton, Ohio.

MINING & METALLURGICAL MACHINERY
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

MINING EQUIPMENT
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Ingersoll-Rand Co., 11 Broadway, New York City.
Jeffrey Mfg. Co., 958 N. 4th St., Columbus, O.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

MINING MACHINES
Goodman Mfg. Co., Forty-eighth Place and Halsted St., Chicago, Ill.
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.

MINING MACHINES CHAIN AND PUNCHER
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.

MINING MACHINES (Electric)
Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.

MINING MACHINERY
Ingersoll-Rand Co., 11 Broadway, New York City.
Jeffrey Mfg. Co., 958 N. 4th St., Columbus, O.

MINE SIGNALS
American Mine Door Co., Canton, Ohio.

MOTORS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.

MOUNTINGS, BOILER
The Lunkenheimer Co., Cincinnati, Ohio.

NITROGEN GAS
Linde Air Products, 30 East 42nd St., New York City.

NON-RETURN BOILER STOP VALVES
The Lunkenheimer Co., Cincinnati, Ohio.

ORE, BUYERS AND SELLERS OF
Irvington Smelting & Refining Works, Irvington, N. J.
Phelps-Dodge Corporation, New York City.

OXYGEN GAS
Linde Air Products, 30 East 42nd St., New York City.

OXY-ACETYLENE APPARATUS and SUPPLIES
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

PACKINGS
Greene, Tweed & Co., 109 Duane St., New York City.

PATENT ATTORNEY
John Boyle, Jr., Ouray Bldg., Washington, D. C.

PERMISSIBLES, Explosives
du Pont Powder Co., The E. I., Wilmington, Del.
Hercules Powder Co., Wilmington, Del.

PICKING TABLES
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd. Chicago, Ill.

PIPE (Wood)
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

PNEUMATIC TOOL
Ingersoll-Rand Co., 11 Broadway, New York City.

POWDER, BLASTING
du Pont Powder Co., The E. I., Wilmington, Del.
Hercules Powder Co., 934 King St., Wilmington, Del.

POWER TRANSMISSION MACHINERY
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Jeffrey Mfg. Co., 958 N. 4th St., Columbus, O.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

PREHEATING APPARATUS
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

PROSPECTIVE DRILLS
H. R. Ameling Prospecting Co., Rolla, Mo.
Heffman Bros., Punxsutawney, Pa.
Ingersoll-Rand Co., 11 Broadway, New York City.

PULLEYS
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

PULVERIZER SCREENS
Ludlow-Saylor Wire Co., 608 S. Newstead Ave., St. Louis, Mo.

PULVERIZERS, COAL AND COKE
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.

PUMPS, AIR LIFT
Ingersoll-Rand Co., 11 Broadway, New York City.

PUMPS, CENTRIFUGAL
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Aurora Pump & Mfg. Co., Aurora, Ill.
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Works), 11 Broadway, New York City.

PUMPS, MINE
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Aurora Pump & Mfg. Co., Aurora, Ill.
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Works), 11 Broadway, New York City.

ROCK DUSTING

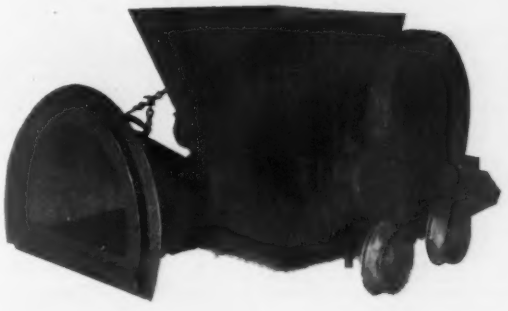
in the most thorough and efficient manner is rapidly accomplished with

The **Legrabon** MINE DUSTING MACHINE

due to its positive feed, large capacity, high velocity of discharge and the peculiar construction of the nozzle.

Unvarying good performance in actual rock dusting practice for several months past has proven it a finished product and not an experiment.

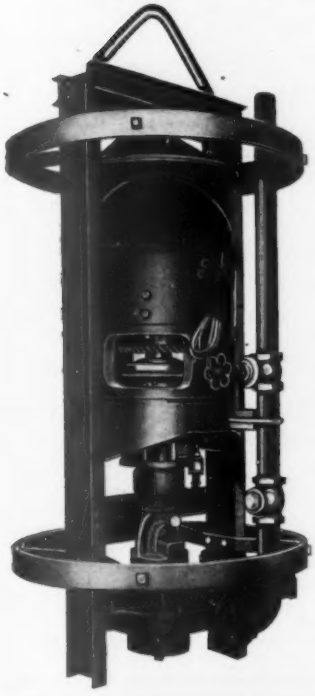
Our new bulletin gives the details.



DIAMOND MACHINE COMPANY
Monongahela, Pa.

Selling Agents: Cooke-Wilson Electric Supply Company
Pittsburgh, Pa., Athens, Ohio, Charleston, W. Va.

Pumps—AURORA—Pumps
For
MINES and INDUSTRIES



Illustrating an AURORA Mine-Sinker, Centrifugal Pump with motor attached.

Can be lowered and raised to suit conditions.

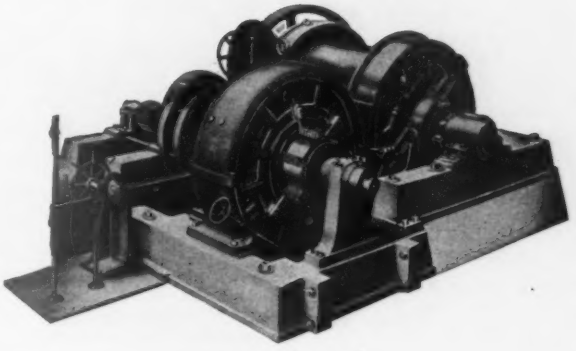
Made in any size and for any capacity.

Also a full line of all mine-water, bronze, centrifugal pumps. Horizontal and vertical.

DEEP WELL TURBINES

Aurora Pump & Mfg. Co.
Aurora, Illinois

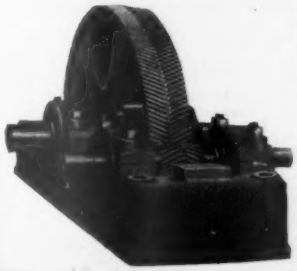
The Connellsville Manufacturing and Mine Supply Company
Connellsville, Pa.



If you need any cost reducing mine equipment, write us.

The Cage, Hoist and Fan Builders

FAWCUS



Use Fawcus Herringbone Gear Drives for driving your hoists, fans, conveyors, picking tables, pumps and compressors. They save 25% to 50% in maintenance and operating costs.

FAWCUS MACHINE CO.
PITTSBURGH, PA.

THRUST
as well as radial load

TIMKEN
Tapered
ROLLER BEARINGS

PUMPS (Electric)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Aurora Pump & Mfg. Co., Aurora, Ill.
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Works), 11 Broadway, New York City.

PUMPS (Gathering or Dip)
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

PUMPS, PNEUMATIC AIR LIFT
Ingersoll-Rand Co., 11 Broadway, New York City.

PUMPS, POWER
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Works), 11 Broadway, New York City.

PUMPS, SAND
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Works), 11 Broadway, New York City.

PUMPS, STEAM
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Works), 11 Broadway, New York City.

PUMPS, VACUUM
Ingersoll-Rand Co., 11 Broadway, New York City.

QUARRYING MACHINERY
Ingersoll-Rand Co., 11 Broadway, New York City.

RAIL BONDS
American Steel & Wire Co., Chicago and New York.
Ohio Brass Co., Mansfield, Ohio.

RAILWAY SUPPLIES
Ohio Brass Co., Mansfield, Ohio.

REFINING PLANTS (Lead)
Traylor Engineering & Mfg. Co., Allentown, Pa.

REGULATORS, Welding, Compressed Gas
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

REK-TANG ROLLED SLOT SCREENS
Ludlow-Saylor Wire Co., 608 S. Newstead Ave., St. Louis, Mo.

RELIEF VALVE
The Lunkenheimer Co., Cincinnati, Ohio.

RIDDLE WIRE CLOTH
Ludlow-Saylor Wire Co., 608 S. Newstead Ave., St. Louis, Mo.

ROCK DRILLS
Ingersoll-Rand Co., 11 Broadway, New York City.
Jeffrey Mfg. Co., 958 N. 4th St., Columbus, O.

RODS, WELDING
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

ROLLER BEARINGS
Hyatt Roller Bearing Co., Harrison, N. J.

ROLLS (Crushing)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Jeffrey Mfg. Co., 958 N. 4th St., Columbus, O.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Traylor Engineering & Mfg. Co., Allentown, Pa.

ROPE
American Steel & Wire Co., Chicago and New York.

ROPE, TRANSMISSION
American Steel & Wire Co., Chicago and New York.
Roebling Sons, John A., Trenton, N. J.

ROPE, WIRE
American Steel & Wire Co., Chicago and New York.
Roebling Sons, John A., Trenton, N. J.

SAFETY APPLIANCES, MINE
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

SAFETY HORN CAR STOPS
G. M. Johnson Mfg. Co., Jeannette, Pa.

SAMPLERS
Traylor Engineering & Mfg. Co., Allentown, Pa.

SCRAPER LOADERS
Goodman Mfg Co., Halsted St. and 48th Place, Chicago, Ill.

SCREEN WIRE CLOTH
Ludlow-Saylor Wire Co., 608 S. Newstead Ave., St. Louis, Mo.

SCREENS, REVOLVING
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Traylor Engineering & Mfg. Co., Allentown, Pa.

SCREENS, SHAKER
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

SCREENS (Trommel)
Traylor Engineering & Mfg. Co., Allentown, Pa.

SCREENS AND PERFORATED SHEETING
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

SHARPENERS, DRILL
Ingersoll-Rand Co., 11 Broadway, New York City.

SIEVE WIRE CLOTH
Ludlow-Saylor Wire Co., 608 S. Newstead Ave., St. Louis, Mo.

SIGNS (Mine)
Stonehouse Signs, Inc., 842 Larimer St., Denver, Colo.

SINKERS, ROCK DRILL
Ingersoll-Rand Co., 11 Broadway New York City.

SKIPS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Jeffrey Mfg. Co., 958 N. 4th St., Columbus, O.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Traylor Engineering & Mfg. Co., Allentown, Pa.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

SMELTERS
Irvington Smelting & Refining Works, Irvington, N. J.
Traylor Engineering & Mfg. Co., Allentown, Pa.

SPECIAL MACHINERY
Fawcus Machine Co., Pittsburgh, Pa.

SPEED REDUCERS
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

SPEED REDUCERS, DOUBLE
Fawcus Machine Co., Pittsburgh, Pa.

SPEED REDUCERS, SINGLE
Fawcus Machine Co., Pittsburgh, Pa.

SPLICE, CABLE
American Mine Door Co., Canton, Ohio.
Ohio Brass Co., Mansfield, Ohio.

SPLICE, INSULATOR
American Mine Door Co., Canton, Ohio.

SPLICE, TROLLEY WIRE
General Electric Co., Schenectady, N. Y.
Ohio Brass Co., Mansfield, Ohio.

SPROCKETS, COMPENSATING
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

SPROCKETS, SILENT CHAIN
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

SPROCKETS, SPRING
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

SPUR GEAR DRIVES
Fawcus Machine Co., Pittsburgh, Pa.

STAMP MILL SCREENS
Ludlow-Saylor Wire Co., 608 S. Newstead Ave., St. Louis, Mo.

STEEL, ALLOY
Central Steel Co., Massillon, Ohio.

STEEL, HIGH FINISH SHEET
Central Steel Co., Massillon, Ohio.

STEEL, HOLLOW & SOLID DRILL
Ingersoll-Rand Co., 11 Broadway, New York City.

STEEL, REINFORCING
American Mine Door Co., Canton, Ohio.

STEEL, STRIP
Central Steel Co., Massillon, Ohio.

STOPERS, ROCK DRILL
Ingersoll-Rand Co., 11 Broadway, New York City.

STORAGE BATTERY LOCOMOTIVES
Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Mancha Storage Battery Locomotive Co., St. Louis, Mo.

SWITCHBOARDS, POWER
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

SWITCHES (Disconnecting and Electric)
General Electric Co., Schenectady N. Y.

SWITCHES AND FROGS, TROLLEY
American Mine Door Co., Canton, Ohio.
Central Frog & Switch Co., Cincinnati, Ohio.
Ohio Brass Co., Mansfield, Ohio.

TIES, (Steel, Mine)
Central Frog & Switch Co., Cincinnati, Ohio.

TIMBER PRESERVING EQUIPMENT
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

TIPPLES
Jeffrey Mfg. Co., 958 N. 4th St., Columbus, O.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

TIPPLE EQUIPMENT
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

TORCHES, Brazing, Carbon Burning, Cutting, Lead Burning, Welding, Welding and Cutting
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

TRACKS, PORTABLE, RAIL, ETC.
Central Frog & Switch Co., Cincinnati, Ohio.
West Virginia Rail Co., Huntington, W. Va.

TRACK, (Portable, Assembled and Unassembled, Riveted or Bolted),
Central Frog & Switch Co., Cincinnati, Ohio.

TRACK SUPPLIES
Central Frog & Switch Co., Cincinnati, Ohio.

TRANSFORMERS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

TRANSMISSION, SILENT CHAIN
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

TRIMMINGS, ENGINE
The Lunkenheimer Co., Cincinnati, Ohio.

TROLLEY FROGS
Ohio Brass Co., Mansfield, Ohio.

TROLLEY (Hangers and Clamps)
General Electric Co., Schenectady, N. Y.
Ohio Brass Co., Mansfield, Ohio.

TROLLEY MATERIAL, OVERHEAD
Ohio Brass Co., Mansfield, Ohio.

TROLLEY WHEELS AND HARPS
Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.
Ohio Brass Co., Mansfield, Ohio.

TRUCKS, WELDER'S
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

TURBINES, HYDRAULIC
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

TURBINES, STEAM
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

VALVES
The Lunkenheimer Co., Cincinnati, Ohio.
Ohio Brass Co., Mansfield, Ohio.

VALVES, Back Pressure, Pressure Reducing
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

WAGON LOADERS
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

WASHERIES
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

WASHER SCREENS
Ludlow-Saylor Wire Co., 608 S. Newstead Ave., St. Louis, Mo.

WATER JACKETS (Smelting Furnace)
Traylor Engineering & Mfg. Co., Allentown, Pa.

WATER RELIEF VALVES
The Lunkenheimer Co., Cincinnati, Ohio.

WEIGHING MACHINES (Automatic)
Streeter-Amet Weighing & Recording Co., Chicago, Ill.

WEIGHT RECORDING MACHINES (Automatic)
Streeter-Amet Weighing & Recording Co., Chicago, Ill.

WELDING and CUTTING APPARATUS, Etc. (Oxy-Acetylene)
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

WELDING APPARATUS, ELECTRIC ARC
Ohio Brass Co., Mansfield, Ohio.

WELDING GAS
Prest-O-Lite Co., Inc., 30 E. 42nd St., New York City.

WELDING SUPPLIES
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

WHISTLES
The Lunkenheimer Co., Cincinnati, Ohio.

WIRE AND CABLE
American Steel & Wire Co., Chicago and New York.
Roebling Sons, The John A., Trenton, N. J.

WIRE CLOTH
Ludlow-Saylor Wire Co., 608 S. Newstead Ave., St. Louis, Mo.

WIRE ROPE FITTINGS
American Steel & Wire Co., Chicago and New York.

WIRE SCREENS
Ludlow-Saylor Wire Co., 608 S. Newstead Ave., St. Louis, Mo.

WIRE, WELDING
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

WORM GEAR DRIVES
Fawcus Machine Co., Pittsburgh, Pa.

CORE DRILLING

H. R. AMELING PROSPECTING COMPANY, INC.

Diamond Drill Contractors

20 Years' Continuous Service
Not a Dissatisfied Customer

ROLLA, MISSOURI

Home: State Geologic Survey, Missouri School of Mines

The
West Virginia Rail Co.

Manufacturers
STEEL RAILS
ACCESSORIES
FROGS and SWITCHES
STEEL MINE TIES
DEFORMED REINFORCING BARS
Mills and General Offices
HUNTINGTON
W. VIRGINIA

New York Engineering Co.

"Empire"

Gold and Tin Dredges
Prospecting Drills
Hydraulic Gravel Elevators
Giants, Sluices, Pipe Lines

NEW YORK ENGINEERING COMPANY
2 RECTOR STREET NEW YORK

Irvington Smelting and Refining Works

Buyers, Smelters and Refiners of
Gold, Silver, Lead, Copper and Platinum
Ores, Sweeps and Bullion

Manufacturers of Copper Sulphate

IRVINGTON :-: NEW JERSEY

NEW YORK OFFICE—Charles Engelhard
Hudson Terminal Building 30 Church Street

Wilmot Engineering Company

Hazleton, Pennsylvania

Manufacturers of

Improved Breaker Machinery for Conveying, Crushing, Sizing and Cleaning Anthracite Coal

Phelps Dodge Corporation

99 JOHN STREET - - NEW YORK

MEMBER COPPER & BRASS RESEARCH ASSOCIATION

Copper

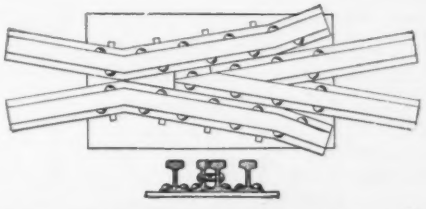
"C ★ Q" Electrolytic
"P. D. Co." Casting

Stonehouse SIGNS, INC.
STONEHOUSE BLDG. 642 LARIMER ST. DENVER COLO. U.S.A.

Stock and Special Signs, Codes, etc., for Mines

Orvis C. Hoffman Leon H. Hoffman
DIAMOND CORE DRILLING
—CONTRACTORS—
HOFFMAN BROS.
PUNXSUTAWNEY, PA.
(Our Specialty—Testing Bituminous Coal Lands)
Up-To-Date Equipments. Expert Drill Runners. Inquiries Solicited

Mine TRACK Equipment



Central Frog & Switch Co.
Cincinnati, Ohio

American Mining Congress

OFFICERS AND COMMITTEES, 1925

OFFICERS

L. S. Cates, *President*
Daniel B. Wentz, *First Vice-President*
E. L. Doheny, *Second Vice-President*
Wm. H. Lindsey, *Third Vice-President*
J. F. Callbreath, *Secretary*

DIVISION STAFF

E. C. Porter, *Convention Manager*
George H. Bailey, *Counsel*
M. W. Kriegh, *Tax Division*
Dr. Henry Mace Payne, *Consulting Engineer*
E. H. Pullman, *Publicity Department*
E. R. Coombes, *Asst. to Secretary*

DIRECTORS

W. J. Loring, Los Angeles, Calif.
Bulkeley Wells, San Francisco, Calif.
Sidney J. Jennings, New York, N. Y.
Daniel B. Wentz, Philadelphia, Pa.
Albert J. Nason, Chicago, Ill.
Wm. H. Lindsey, Nashville, Tenn.
J. G. Bradley, Dundon, W. Va.
H. W. Seaman, Chicago, Ill.
E. L. Doheny, New York, N. Y.
Hugh Shirkie, Terre Haute, Ind.
Stanly Easton, Kellogg, Idaho.
F. L. Morse, Ithaca, N. Y.
L. S. Cates, Salt Lake City, Utah.

EXECUTIVE COMMITTEE

H. W. Seaman — Sidney J. Jennings
Albert J. Nason

WESTERN DIVISION

BOARD OF GOVERNORS

Robert E. Tally, United Verde Copper Co., Jerome, Ariz., *Chairman of the Division.*
W. B. Gohring, 419 Heard Building, Phoenix, Ariz., *Secretary of the Division.*
Arizona—Robert E. Tally, United Verde Copper Co., Jerome, Ariz.; W. B. Gohring, 419 Heard Building, Phoenix, Ariz.
California—W. J. Loring, 301 Merchants National Bank Bldg., Los Angeles, Calif.; Robert I. Kerr, 509 United Bank & Trust Co. Bldg., 625 Market St., San Francisco, Calif.
Colorado—Geo. A. Stahl, Room 12, State Capitol, Denver, Colo.; M. B. Tomblin, 436 State Office Building, Denver, Colo.
Idaho—A. P. Ramstedt, Wallace, Idaho; Ravenel Macbeth, Idaho Mining Association, Wallace, Idaho.
Montana—Wm. F. Word, Box 687, Helena, Mont.
Nevada—Emmet D. Boyle, Mason Valley Mines Co., Mason, Nev.; Henry M. Rives, Nevada Mine Operators' Assn., Reno, Nev.
New Mexico—John M. Sully, Chino Copper Co., Hurley, N. M.; Jos. Woodbury, New Mexico Chapter, The American Mining Congress, Silver City, N. Mex.
Oregon—Robert M. Betts, Cornucopia Mining Co., Cornucopia, Oreg.
South Dakota—B. C. Yates, Homestake Mining Co., Lead, S. Dak.
Utah—V. S. Rood, Utah Apex Mining Co., Bingham, Utah; A. G. Mackenzie, 212 Kearns Building, Salt Lake City, Utah.
Washington—Raymond Guyer, Symons Building, Spokane, Wash.

SOUTHERN DIVISION

BOARD OF GOVERNORS

W. H. Lindsey, Napier Iron Works, Nashville, Tenn.
J. B. McClary, Yolande Coal & Coke Co., Birmingham, Ala.
Percy D. Berry, Providence Coal Mining Co., Providence, Ky.
Lee Long, Clinchfield Coal Corporation, Dante, Va.
S. L. Hertzog, Cherokee Mining Co., Spartansburg, S. C.
W. S. Peebles, The Paga Mining Co., Cartersville, Ga.
S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.
H. B. Flowers, New Orleans Public Service, Inc., New Orleans, La.
C. J. Griffith, Arkansas Central Power Co., Little Rock, Ark.
Dr. Joseph Hyde Pratt, Western North Carolina, Inc., Asheville, N. C.
W. H. Smith, Secy.-Mgr., Chamber of Commerce, Laurel, Miss.
C. A. Memminger (Florida), Pres., Coronet Phosphate Co., Asheville, N. C.

MANUFACTURERS DIVISION

OFFICERS

Honorary Chairman

N. S. Greensfelder, Hercules Powder Co., Wilmington, Del.

Chairman

J. C. Wilson, Ohio Brass Co., Mansfield, Ohio.

Vice-Chairmen

H. K. Porter, Hyatt Roller Bearing Co., Harrison, N. J.
C. L. Herbster, Hockensmith Wheel & Mine Car Co., Penn, Pa.
H. A. Buzby, Keystone Lubricating Co., Philadelphia, Pa.

Members

Atlas Powder Co., Wilmington, Del. W. H. Dawson.
Automatic Reclosing Circuit Breaker Co., Columbus, Ohio. C. M. Hickle.
Carnegie Steel Co., Pittsburgh, Pa. R. L. Twitchell.
Central Frog & Switch Co., Cincinnati, Ohio. E. R. Heitzmann.
E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. E. F. Carley.
Edison Storage Battery Co., Orange, N. J. G. E. Stringfellow.
General Electric Co., Schenectady, N. Y. L. W. Shugg.
Hercules Powder Co., Wilmington, Del. N. S. Greensfelder.
Hockensmith Wheel & Mine Car Co., Penn, Pa. C. L. Herbster.
Robt. Holmes & Bros., Inc., Danville, Ill. F. R. Holmes.
Hyatt Roller Bearing Co., Newark, N. J. H. K. Porter.
Keystone Consolidated Publishing Co., Pittsburgh, Pa. Ralph C. Becker.
Keystone Lubricating Co., Philadelphia, Pa. H. A. Buzby.
Ludlow-Saylor Wire Co., St. Louis, Mo. Duncan Meier.
Mancha Storage Battery Locomotive Co., St. Louis, Mo. Raymond Mancha.
Myers-Whaley Co., Knoxville, Tenn. Wm. A. Whaley.
Morse Chain Co., Ithaca, N. Y. C. L. Saunders.
Ohio Brass Co., Mansfield, Ohio. J. C. Wilson.
John A. Roebling's Sons Co., Trenton, N. J. F. J. Maple.
Southern Wheel Co., St. Louis, Mo. W. C. Appleby.
Streeter-Amet Weighing & Recording Co., Chicago, Ill. H. F. Reck.
Timken Roller Bearing Co., Canton, Ohio. E. R. Phillips.
W. S. Tyler Co., Cleveland, Ohio. M. P. Reynolds.
Weir Frog Co., Cincinnati, Ohio. J. K. Lansdowne.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. P. H. Grunnagle.

TAX DIVISION

GENERAL TAX COMMITTEE

Paul Armitage, *Chairman*
233 Broadway, New York, N. Y.
Geo. E. Holmes, *Vice-Chairman*
15 William St., New York, N. Y.

R. C. Allen, Hanna Building, Cleveland, Ohio.
A. Scott Thompson, Miami, Okla.
Wm. B. Gower, 20 Exchange Place, New York, N. Y.
R. V. Norris, 520 Second National Bank Bldg., Wilkes-Barre, Pa.
J. C. Dick, 511 Newhouse Bldg., Salt Lake City, Utah.
A. P. Ramstedt, Wallace, Idaho.
E. L. Doheny, 120 Broadway, New York City.
T. O. McGrath, Bisbee, Ariz.
Robt. N. Miller, Southern Bldg., Washington, D. C.
H. B. Fernald, 50 Broad St., New York City.
T. T. Brewster, Federal Res. Bank Bldg., St. Louis, Mo.
Wm. N. Davis, Bartlesville, Okla.

STANDARDIZATION DIVISION

Metal and Coal Mining Branches

COAL MINING BRANCH

General Committee

Colonel Warren R. Roberts (*Chairman*), Pres., Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.
R. L. Adams, Chf. Engr., Old Ben Coal Corpn., Christopher, Ill.
D. J. Carroll, Chicago, Wilmington & Franklin Coal Co., 332 South Michigan Ave., Chicago, Ill.
A. B. Kiser, Supt. of Elec. Equipment, Pittsburgh Coal Co., Pittsburgh, Pa.
J. A. Malady, Master Mech. & Elec. Engr., Hillman Coal & Coke Co., 2307 First Natl. Bank Bldg., Pittsburgh, Pa.
James Needham, Genl. Supt. of Mines, St. Paul Coal Co., 1368 Fullerton Ave., Chicago, Ill.
Fred Norman, Chf. Engr., Allegheny River Mining Co., Kittanning, Pa.
F. L. Stone, Industrial Engr. Dept., General Electric Co., Schenectady, N. Y.
C. H. Trik, Sales and Mine Ventilation Engr., Jeffrey Mfg. Co., Columbus, Ohio.

Underground Transportation
Fred Norman, *Chairman*

MAIN COMMITTEE

Fred Norman (*Chairman*), Chf. Engr., Allegheny Rivers Mining Co., Kittanning, Pa.
Frank S. Barks, Pres., Lincoln Steel and Forge Co., St. Louis, Mo.
Graham Bright, Cons. Engr., Howard N. Eavenson & Associates, 1302 Union Trust Bldg., Pittsburgh, Pa.
Jos. Bryan, Salesman, General Electric Co., 535 Smithfield St., Pittsburgh, Pa.
John T. Cherry, Genl. Supt., B. F. Berry Coal Co., Standard, Ill.
Frederick C. Coseo, Chf. Draftsman, Jeffrey Mfg. Co., Columbus, Ohio.
A. H. Ehle, Mgr., Domestic Sales, Baldwin Locomotive Works, 500 N. Broad St., Philadelphia, Pa.
W. J. Fene, Asst. Chf. Engr., Mine Safety Service, U. S. Bureau of Mines, 4800 Forbes St., Pittsburgh, Pa.
Robert J. Forester, Supt., Paradise Coal Co., Du Quoin, Ill.
J. B. Forrester, Chf. Engr., United States Fuel Co., Hiawatha, Utah.
D. F. Lepley, Pres. & Genl. Mgr., Connellsville Mfg. and Supply Co., Connellsville, Pa.
J. D. Martin, Genl. Supt. of Coal Mines, Virginia Iron, Coal & Coke Co., Payne Bldg., Roanoke, Va.
Charles M. Means, Cons. Engr., Charles M. Means Company, 447 Oliver Bldg., Pittsburgh, Pa.
James Milliken, Pres., Pittsburgh Testing Laboratory, P. O. Box 1115, Pittsburgh, Pa.
T. A. Parker, 407 Olive St., St. Louis, Mo.
Chas. H. Partington, Chief Engr., Cincinnati Frog & Switch Co., Cincinnati, Ohio.
H. K. Porter, Car & Truck Dept., Hyatt Roller Bearing Co., Newark, N. J.
G. H. Shapter, Commercial Engr., Industrial Dept., General Electric Co., Erie, Pa.
E. A. Watters, Genl. Supt., Hick Coal Companies, Box 405, Leechburg, Pa.
C. E. Watts, Mech. Engr., Berwind White Coal Mining Co., Windber, Pa.

SUB-COMMITTEE NO. 1—COAL MINE CAR DESIGN AND CONSTRUCTION

James Milliken (*Chairman*), Pres., Pittsburgh Testing Laboratory, P. O. Box 1115, Pittsburgh, Pa.
H. M. Estabrook, Standard Steel Car Co., Frick Bldg., Pittsburgh, Pa.
W. K. W. Hansen, Plant Mgr., Hockensmith Wheel & Mine Car Co., Penn, Pa.
R. L. Kingsland, Genl. Supt., Power & Mechanical Dept., Consolidation Coal Co., Fairmont, W. Va.
A. E. Ostrander, American Car & Foundry Co., 165 Broadway, New York City.
W. C. Sanders, Rwy. Equipment Engr., Timken Roller Bearing Co., Canton, Ohio.
C. E. Watts, Mech. Engr., Berwind White Coal Mining Co., Windber, Pa.
C. K. Witmer, Master Mechanic, Westmoreland Coal Co., Irwin, Pa.

SECTIONAL COMMITTEE ON TYPES OF HAND BRAKES

Thos. G. Fear, Genl. Supt., Inland Collieries Co., Indianola, Pa.
Wm. J. Hill, Senior Mine Inspector, Travelers Insurance Co., 1103 Commonwealth Bldg., Pittsburgh, Pa.
W. H. Robinson, Chf. Inspector, The Associated Companies, 207 Fulton Bldg., Pittsburgh, Pa.

SECTIONAL COMMITTEE ON MINE CAR WHEELS

C. K. Witmer (Chairman), Master Mechanic, Westmoreland Coal Co., Irwin, Pa.
W. E. Farrell, Pres., Easton Car and Construction Co., Easton, Pa.
John M. Lewis, Chf. Engr., Houston Coal and Coke Co., 1532 Union Trust Bldg., Cincinnati, O.
Arthur Neale, Asst. Genl. Mgr. of Mines, Pittsburgh Coal Co., 1018 Oliver Bldg., Pittsburgh, Pa.
Cecil W. Smith, Chf. Engr., Illinois Coal Corpn., 1380 Old Colony Bldg., Chicago, Ill.
W. G. Srodes, Supt., Coal and Coke Dept., Shenango Furnace Co., Ligonier, Pa.

SUB-COMMITTEE NO. 2—MINE TRACKS AND SIGNALS

Chas. H. Partington (*Chairman*), Chf. Engr., Cincinnati Frog & Switch Co., Cincinnati, O.
Wm. P. Buckwalter, Vice-Pres.; Martin J. O'Breire Co., 803 Union Bank Bldg., Pittsburgh, Pa.
G. M. Crawford, Crawford Machinery Co., 1117 Bessemer Bldg., Pittsburgh, Pa.
R. G. Crawford, Sales Engr., American Frog & Switch Co., 1207 Diamond Bank Bldg., Pittsburgh, Pa.
A. A. Culp, Birmingham, Ala.
R. G. Detmer, Chf. Engr., The American Frog & Switch Co., Hamilton, Ohio.
Thos. H. Edelblute, T. H. Edelblute Company, Wabash Bldg., Pittsburgh, Pa.

THE KEYSTONE LUBRICATING CO.
Executive Office and Works: Philadelphia, Pa.

Blue Center Steel
Wire Rope
Made of a Superior Grade of Steel Produced in our own furnaces

JOHN A. ROEBLING'S SONS CO.
TRENTON, N. J.

THORNE, NEALE & COMPANY., Inc.

FRANKLIN BANK BUILDING
1416 CHESTNUT STREET—9 A. M. to 4 P. M.
PHILADELPHIA, PA.

MINERS' AGENTS AND WHOLESALE DEALERS

Anthracite* COAL *Bituminous

ANTHRACITE COLLIERIES

Mt. Lookout · Harry E · Forty Fort · New Castle · Locust Run (Washery)
Sterrick Creek · Northwest · Lackawanna · Buck Run

Pardee Bros. & Co.— Lattimer Lehigh

BITUMINOUS

Sonman, South Fork District—Low volatile, low ash, low sulphur

Smithing—1 1-4 in. screened

Fairmont — Quemahoning — Indiana County

NEW YORK OFFICE: 17 BATTERY PLACE

Branch Offices: Baltimore Buffalo Chicago Scranton, Pa Mauch Chunk, Pa.

Are Operating Problems Worrying You ?

If your Practical Operating problems are a cause of worry to you, we believe you will be helped materially by turning to our new feature, The Practical Operating Men's Department to be found in this and following issues.

G.M. JOHNSON MFG. CO. Jeannette, Pa.

MANUFACTURERS OF
Mine Cages & Automatic Caging Devices.
Safety Horn Car Stops.
Chain Rail Car Hauls.
Automatic Gravity Feeders.
Automatic Switch Throwers.

JOHN BOYLE, JR.
Attorney-at-Law
Patents
B. S. IN MINING ENGINEERING AND METALLURGY. SIXTEEN YEARS IN THE EXAMINING CORPS OF THE UNITED STATES PATENT OFFICE.
OURAY BUILDING, WASHINGTON, D. C.

OFFICERS AND COMMITTEES, 1925—(Continued)

R. L. Gillispie, Asst. Supt., F. & S. Division, Bethlehem Steel Co., 322 Spruce St., Steelton, Pa.
Wm. F. Henke, Asst. Engr., Cincinnati Frog & Switch Co., Cincinnati, O.
F. C. Hohn, Engr., Pennsylvania Appraisal Co., 715 Traders Natl. Bank Bldg., Scranton, Pa.
F. W. Holcombe, American Frog and Switch Co., Hamilton, Ohio.
Wm. G. Hulbert, Genl. Supt., Wm. Wharton, Jr., & Co., Inc., Easton, Pa.
W. P. Jones, Supt., A. R. Mining Co., Chickasaw, Pa.
A. S. Karr, Sales Agent, Weir Frog Co., P. O. Box 1254, Pittsburgh, Pa.
Herman L. Koch, Mgr., Industrial Dept. Sweet's Steel Co., Williamsport, Pa.
F. J. McGrath, Genl. Supt., Sweet's Steel Co., Williamsport, Pa.
Charles C. Steel, Genl. Mgr. of Sales, Sweet's Steel Co., Williamsport, Pa.
Thomas H. Thompson, Mine Inspector, Kittanning, Pa.
J. R. Ulrich, Bethlehem Steel Co., Bethlehem, Pa.
H. N. West, Chf. Engr. and Works Mgr., Weir Frog. Co., Norwood, Ohio.
Arthur White, Supt. of Mines, Seminole, Pa.
John Woodall, Mine Supt., Conifer, Pa.

SUB-COMMITTEE NO. 3—MINE LOCOMOTIVES

Graham Bright (*Chairman*), Cons. Engr., Howard N. Eavenson & Associates, 1302 Union Trust Bldg., Pittsburgh, Pa.
Jos. Bryan, Salesman, General Electric Co., 535 Smithfield St., Pittsburgh, Pa.
Frederick C. Coseo, Chf. Draftsman, Jeffrey Mfg. Co., Columbus, Ohio.
Thos. F. Downing, Jr., The Edw. V. d'Invilliers Engr. Co., Central Bldg., Philadelphia, Pa.
A. H. Ehle, Mgr., Domestic Sales, Baldwin Locomotive Works, 500 N. Broad St., Philadelphia, Pa.
S. W. Farnham, Mng., Engr., Goodman Mfg. Co., 4834 S. Halstead St., Chicago, Ill.
W. J. Fene, Asst. Chf. Engr., Mine Safety Service, U. S. Bureau of Mines, 4800 Forbes St., Pittsburgh, Pa.
G. H. Shapter, Commercial Engr., Industrial Dept., General Electric Co., Erie, Pa.

Mining and Loading Equipment

D. J. Carroll, *Chairman*

SUB-COMMITTEE NO. 1—LOADERS

SECTION "A"—LOADING MACHINES AND METHODS OF LOADING

Frank E. Cash, U. S. Bureau of Mines, 4800 Forbes St., Pittsburgh, Pa.
G. W. Hay, Gen'l Mgr., Consolidation Coal Co., Jenkins, Ky.
T. E. Jenkins, Vice-Pres., West Kentucky Coal Co., Sturgis, Ky.
J. F. Joy, Pres., Joy Machine Co., Franklin, Pa.
N. D. Levin, Jeffrey Mfg. Co., Columbus, O.
N. H. McClevey, Vice-Pres. and Gen'l Mgr., Pike County Coal Corpn., Petersburg, Ind.
W. D. Turnbull, Genl. Engr. Dept., Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
William Whaley, Gen'l Mgr., Myers-Whaley Co., Knoxville, Tenn.

SECTION "B"—IN THICK AND THIN COAL, WITH VARYING ROOF CONDITIONS

E. K. Bowers, Ass't Treas., Morgan-Gardner Elec. Co., 2640 Shields Ave., Chicago, Ill.
Frank E. Cash, U. S. Bureau of Mines, 4800 Forbes St., Pittsburgh, Pa.
S. W. Farnham, Mng. Engr., Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.
Walter Stevens, Supt., Raleigh-Wyoming Coal Co., Glen Rogers, W. Va.
F. W. Whiteside, Chf. Engr., Victor-American Fuel Co., Denver, Colo.

SUB-COMMITTEE NO. 2—CONVEYORS

Newell G. Alford, Mng. Engr., Union Trust Bldg., Pittsburgh, Pa.
E. H. Coxe, Gen'l Mgr., Snowdon Coke Co., Brownsville, Pa.
T. W. Dawson, Cons. Engr., H. C. Frick Coke Co., Scottdale, Pa.
Chas. Gottschalk, Cons. Engr., 920 Citizens Bank Bldg., Evansville, Indiana.
E. F. Miller, Gen'l Supt., Bertha-Consumers Coal Co., Rachel, W. Va.
G. B. Southward, Chief Engr., West Virginia Coal and Coke Co., Elkins, W. Va.
D. A. Stout, Mgr., Fuel Dept., Colorado Fuel and Iron Co., Pueblo, Colorado.
F. G. Wilcox, Pres., West End Coal Co., Scranton, Pa.
J. D. Zook, Vice-Pres., Illinois Coal Corpn., 37 Van Buren St., Chicago, Ill.

SUB-COMMITTEE NO. 3—CUTTING MACHINES

Carl Scholz (Chairman), Vice-Pres., Raleigh-Wyoming Coal Co., Charleston, W. Va.
Walter Calverley, Pres., Fayette Coal Corpn., Farmers Bank Bldg., Pittsburgh, Pa.
A. P. Cameron, Gen'l Mgr., Westmoreland Coal Co., Irwin, Pa.
J. M. Clark, Vice-Pres., Clark & Krebs, Inc., Charleston, W. Va.
H. P. Dyer, Gen'l Mgr., Vandalia Coal Co., Sullivan, Ind.
G. T. Haldeman, U. S. Bureau of Mines, Washington, D. C.
Wm. E. Hamilton, Mgr., Hamilton Engineering Co., 310 Schultz Bldg., Columbus, O.
E. S. McKinlay, Pres., McKinlay Mining and Loading Machine Co., Point Pleasant, W. Va.
M. Mitchell, Sullivan Machinery Co., St. Louis, Mo.

Mine Drainage

J. A. Malady, *Chairman*

SUB-COMMITTEE NO. 1—PUMPS FOR DEVELOPMENT WORK

L. W. Householder (*Chairman*), Chf. Engr., Rochester & Pittsburgh Coal & Iron Co., Indiana, Pa.
E. F. Austin, Dravo-Doyle Co., Pittsburgh, Pa.
Herbert Axford, Sales Engr., Ingersoll-Rand Co., 610 Spruce St., Scranton, Pa.
Harold P. Dyer, Genl. Mgr., Vandalia Coal Co., Sullivan, Ind.
J. H. Edwards, Associate Editor, Coal Age, 2962 Winters Rd., Huntington, W. Va.
F. J. Emeny, Vice Pres., The Deming Co., Salem, Ohio.
J. E. Holveck, Dist. Mgr., Aldrich Pump Co., 1209 Empire Bldg., Pittsburgh, Pa.
G. E. Huttle, Mech. Engr., H. C. Frick Coke Co., Scottdale, Pa.
Chas. H. Matthews, Genl. Engr. in Chg. Mining Section, Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
H. J. Nelms, Genl. Supt., New Field By-Products Coal Co., North Bessemer, Pa.
J. S. O'Flaherty, Chf. Engr., Central Coal & Coke Co., Keith & Perry Bldg., Kansas City, Mo.
F. W. Smith, Hydroelectric Pump & Supply Co., Curry Bldg., Pittsburgh, Pa.

SUB-COMMITTEE NO. 2—PERMANENT PUMPING STATIONS

Parker Cott (*Chairman*), Salesman, Coal Mine Equipment Co., 2218 Farmers Bank Bldg., Pittsburgh, Pa.
Herbert Axford, Sales Engr., Ingersoll-Rand Co., 610 Spruce St., Scranton, Pa.
Henry E. Cole, Vice Pres., Harris Pump & Supply Co., 320 Second Ave., Pittsburgh, Pa.
J. P. Heidenreich, Asst. Genl. Mgr., Scranton Pump Co., Scranton, Pa.
W. L. Robison, Vice Pres., Youghiogheny & Ohio Coal Co., 1230 Hanna Bldg., Cleveland, O.
R. F. Roth, Emmons Coal Mining Co., Altoona, Pa.
Cecil W. Smith, Chf. Engr., Illinois Coal Corpn., 1380 Old Colony Bldg., Chicago, Ill.
M. Spillman, Works Engr., Worthington Pump & Machinery Corpn., Harrison, N. J.
L. D. Tracy, Supt., U. S. Bureau of Mines, 312 Ceramics Bldg., Urbana, Ill.

SUB-COMMITTEE NO. 3—NATURAL DRAINAGE

John Brunschwyler (*Chairman*), Div. Supt., Boomer Coal & Coke Co., Boomer, W. Va.
M. C. Benedict, Cons. Engr., Brown Equipment Co., 940 Ash St., Johnstown, Pa.
Oscar Cartlidge, Cons. Engr., 1593 Lee St., Charleston, W. Va.
L. P. Creccelius, Engr., Cleveland & Western Coal Co., 1517 Union Trust Bldg., Cleveland, Ohio.
E. D. Knight, 2207 Washington St., Charleston, W. Va.
R. Y. Wert, Supt., Durham Coal & Iron Co., Soddy, Tenn.

SUB-COMMITTEE NO. 4—UNWATERING ABANDONED WORKINGS

Prof. John W. Hallock (*Chairman*), Head of Department of Industrial Engineering, University of Pittsburgh, Pittsburgh, Pa.
G. E. Huttle, Mech. Engr., H. C. Frick Coke Co., Scottdale, Pa.
J. A. Malady, Master Mech. & Elec. Engr., Hillman Coal & Coke Co., Pittsburgh, Pa.
O. M. Pruitt, Pres., Indiana Air Pump Co., Indiana Pythian Bldg., Indianapolis, Ind.
Chas. A. Straw, Cons. Mech. Engr., Hudson Coal Co., 434 Wyoming Ave., Scranton, Pa.
G. V. Woody, Mgr., Allis-Chalmers Mfg. Co., Wilkes-Barre, Pa.

SUB-COMMITTEE NO. 5—MINE WATER AND ITS ACTION UPON MINE DRAINAGE EQUIPMENT

Geo. A. Drysdale (*Chairman*), Metallurgical Elitor, Foundry, Penton Publishing Co., Cleveland, Ohio.
M. L. Bettcher, Production Engr., The Duriron Co., Inc., Dayton, Ohio.
J. R. Campbell, Hudson Coal Co., Scranton, Pa.
Geo. Watkin Evans, Cons. Coal Mng. Engr., L. C. Smith Bldg., Seattle, Wash.
Carl J. Fletcher, Vice Pres., Knox Coal Mng. Co., Merchants Bank Bldg., Indianapolis, Ind.
C. L. Harrod, Elec. Engr., Indiana Coal Oprs. Power Assn., 1509 Merchants Bank Bldg., Indianapolis, Ind.
Martin J. Lide, Cons. Engr., Woodward Bldg., Birmingham, Ala.
Frank G. Morris, Genl. Supt. of Mines, Republic Iron & Steel Co., Sayreton, Ala.
J. S. O'Flaherty, Chf. Engr., Central Coal & Coke Co., Keith & Perry Bldg., Kansas City, Mo.
L. D. Rover, Power & Construction Dept., Ford Motor Co., Detroit, Mich.
W. H. Waddington, Sales Engr., Driver-Harris Co., Harrison, N. J.

Mine Ventilation

C. H. Trik, *Chairman*

SUB-COMMITTEE NO. 1—AIR SHAFTS AND AIR WAYS

J. C. Gaskill (*Chairman*), Asst. Cons. Engr., Consolidation Coal Co., Fairmont, W. Va.
C. H. Beidenmiller, Mgr., Glogora Coal Co., 705 First Natl. Bank Bldg., Huntington, W. Va.
J. H. Doughty, Mech. Engr., Lehigh & Wilkes-Barre Coal Co., 16 So. River St., Wilkes-Barre, Pa.
Robert Wallace, Supt., Pocahontas Fuel Co., Inc., Pocahontas, Va.
Jos. J. Walsh, Secretary of Mines, Pennsylvania Dept. of Mines, Harrisburg, Pa.

SUB-COMMITTEE NO. 2—MINE FAN INSTALLATION

G. E. Lyman (*Chairman*), Genl. Supt., Madison Coal Corpn., Glen Carbon, Ill.
H. G. Conrad, Genl. Mgr., American Coal Mining Co., Bicknell, Ind.
R. B. Fleming, Evansburg Coal Co., Colver, Pa.
E. B. Wagner, Lehigh Valley Coal Co., Wilkes-Barre, Pa.

SUB-COMMITTEE NO. 3—BOOSTER FANS

R. Dawson Hall (*Chairman*), Engineering Editor, Coal Age, 10th Ave. at 36th St., New York City.
Howard N. Eavenson, Pres., Howard N. Eavenson & Associates, 1302 Union Trust Bldg., Pittsburgh, Pa.
R. H. Moore, Genl. Mgr., C. A. Hughes & Co., Portage, Pa.
E. N. Zern, Editor, Mining Catalog, Keystone Cons. Publishing Co., 800 Penn Ave., Pittsburgh, Pa.

SUB-COMMITTEE NO. 4—MINE ATMOSPHERE

Thomas Chester (*Chairman*), Cons. Engr., 2970 W. Grand Blvd., Detroit, Mich.
Martin J. Lide, Cons. Engr., Woodward Bldg., Birmingham, Ala.
R. M. Perry, Genl. Supt., Moffat Coal Co., 504 Gas & Elec. Bldg., Denver, Colo.
H. B. Wright, Chf. Engr., Pocahontas Fuel Co., Inc., Pocahontas, Va.

Outside Coal Handling Equipment

James Needham, *Chairman*

Hubb Bell, Sales Chemist, C. P. Chemical & Drug Co., Inc., 114 Liberty St., New York City.
J. W. Bischoff, Vice Pres. & Genl. Mgr., West Virginia Coal & Coke Co., Elkins, W. Va.
W. G. Duncan, Jr., Supt., W. G. Duncan Coal Co., Greenville, Ky.
H. H. Elkins, Supt. of Mines, Valley Camp Coal Co., St. Clairsville, Ohio.
M. A. Kendall, Chf. Engr., Stephens-Adamson Mfg. Co., Aurora, Ill.
Rudolf Kudlich, Asst. to Chf. Mech. Engr., U. S. Bureau of Mines, Washington, D. C.
John J. Moore, Dey & Maddock, 82d and Dennison Sts., Cleveland, Ohio.
F. G. Morris, Genl. Supt. of Coal Mines, Republic Iron & Steel Co., Sayreton, Ala.
G. H. Morse, Genl. Supt., Republic Iron & Steel Co., Oliver Bldg., Pittsburgh, Pa.
H. F. Nash, Vice Pres. & Genl. Mgr. of Sales, Oakdale Coal Co., Gas and Electric Bldg., Denver, Colo.
Warren R. Roberts, Pres., Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.
H. D. Smith, Genl. Supt., American Coal Co. of Allegany County, McComas, W. Va.
C. K. Stahl, Asst. to Genl. Mgr., E. E. White Coal Co., Stotesbury, W. Va.
C. Law Watkins, Vice Pres., Pennsylvania Coal & Coke Corpn., Cresson, Pa.
F. W. Whiteside, Chf. Engr., Victor-American Fuel Co., Ernest & Cranmer Bldg., Denver, Colo.

Underground Power Transmission

A. B. Kiser, *Chairman*

W. A. Chandler, Elec. Engr., Hudson Coal Co., Scranton, Pa.
Harvey Conrad, Genl. Mgr., American Coal Mng. Co., Bicknell, Ind.
L. C. Ilsley, U. S. Bureau of Mines, 4800 Forbes St., Pittsburgh, Pa.
R. L. Kingsland, Genl. Supt., Power and Mechanical Dept., Consolidation Coal Co., Fairmont, W. Va.
Carl Lee, Elec. Engr., Peabody Coal Co., 1662 McCormick Bldg., Chicago, Ill.
Wm. Schott, Cons. Engr., Big Creek Coal Co. Chicago, Ill.
Henry M. Warren, Cons. Engr., Glen Alden Coal Co., 300 Jefferson Ave., Scranton, Pa.

Power Equipment

F. L. Stone, *Chairman*

W. C. Adams, Allen & Garcia, Chicago, Ill.
Graham Bright, Cons. Engr., Howard N. Eavenson & Associates, 1302 Union Trust Bldg., Pittsburgh, Pa.

OFFICERS AND COMMITTEES, 1925—(Continued)

Stephen H. Green, Pacific Coast Coal Co., Seattle, Wash.
O. P. Hood, Chf. Mech. Engr., U. S. Bureau of Mines, Washington, D. C.
J. T. Jennings, Power Engr., Philadelphia & Reading Coal & Iron Co., Pottsville, Pa.
R. L. Kingsland, Consolidation Coal Co., Fairmont, W. Va.
M. D. Kirk, Vesta Coal Co., Jones & Laughlin Bldg., Pittsburgh, Pa.
Chas. Legrand, Cons. Engr., Phelps Dodge Corpn., Douglas, Ariz.
Martin J. Lide, Cons. Engr., Woodward Bldg., Birmingham, Ala.
D. C. McKeehan, Chf. Elec., Union Pacific Coal Co., Rock Springs, Wyo.
J. A. Malady, Master Mech. & Elec. Engr., Hillman Coal & Coke Co., 2307 First National Bank Bldg., Pittsburgh, Pa.
A. J. Nicht, Jr., Engr., Hoisting Equipment, Allis-Chalmers Mfg. Co., Milwaukee, Wis.
W. C. Shunk, Stonega Coal & Coke Co., Big Stone Gap, Va.
Geo. S. Thompson, Chf. Elec. & Master Mech., Colorado Fuel & Iron Co., Pueblo, Colo.
C. D. Woodward, Chf. Elec. Engr., Anaconda Copper Mining Co., 514 Hennessy Bldg., Butte, Mont.

Mine Timbering

R. L. Adams, *Chairman*

SUB-COMMITTEE NO. 1—GENERAL MINE TIMBERING, SIMPLIFICATION ON GRADES AND NAMES

J. R. Sharp (Chairman), care of C. F. Kurtz Co., Rock Island, Ill.
Newell G. Alford, Vice Pres., Howard N. Eavenson & Associates, 1302 Union Trust Bldg., Pittsburgh, Pa.
R. W. Austin, Austin & Wood, North 3rd St., Clearfield, Pa.
J. R. Crowe, Jr., Pres., Crowe Coal Co., Dwight Bldg., Kansas City, Mo.
D. F. Holtman, Construction Engr., National Lumber Mfgrs. Assn., 402 Transportation Bldg., Washington, D. C.
G. A. Knox, Supt., Gunn-Quealey Coal Co., Quealy, Wyoming.
Ernest M. Merrill, Pres., Merrill-Ferguson Engineering Co., 506 Kanawha Bank & Trust Bldg., Charleston, W. Va.
Chas. N. Perrin, Chairman, Rules Committee, National Hardwood Lumber Assn., Bank of Wisconsin Bldg., Madison, Wis.
George S. Rice, Chf. Mng. Engr., U. S. Bureau of Mines, Washington, D. C.
Geo. T. Stevens, Chf. Engr., Clinchfield Coal Corpn., Dante, Va.

SUB-COMMITTEE NO. 2—PRESERVATION OF MINE TIMBERS

Geo. M. Hunt (*Chairman*), In Charge of Wood Preservation Section, Forest Products Laboratory, Madison, Wis.
W. L. Affelder, Asst. to Pres., Hillman Coal and Coke Co., 2306 First Natl. Bank Bldg., Pittsburgh, Pa.
R. W. Austin, Austin & Wood, North 3rd St., Clearfield, Pa.
M. H. Sellers, Chicago, Wilmington & Franklin Coal Co., Carbondale, Ill.
D. A. Stout, Mgr., Fuel Dept., Colorado Fuel & Iron Co., Pueblo, Colo.

SUB-COMMITTEE NO. 3—USE OF CONCRETE IN MINE TIMBERING

Newell G. Alford (*Chairman*), Vice-Pres., Howard N. Eavenson & Associates, 1302 Union Trust Bldg., Pittsburgh, Pa.
B. C. Collier, Pres., Cement-Gun Co., Inc., Allentown, Pa.
W. R. Peck, Chf. Engr., Black Diamond Collieries, Coal Creek, Tenn.
H. S. Wright, Engr., Structural Bureau, Portland Cement Assn., 111 W. Washington St., Chicago, Ill.

SUB-COMMITTEE NO. 4—USE OF STRUCTURAL STEEL FOR MINE TIMBERING

(Personnel not appointed.)

SUB-COMMITTEE NO. 5—SALVAGE OF MINE TIMBERS

George T. Stevens (*Chairman*), Chf. Engr., Clinchfield Coal Corpn., Dante, Va.

METAL MINING BRANCH

General Committee

Charles A. Mitke (*Chairman*), Cons. Mng. Engr., Phoenix, Ariz.
Frank Ayer, Mgr., Moctezuma Copper Co., Nacozari, Sonora, Mexico.
Wm. Conibear, Safety Inspector, Cleveland-Cliffs Iron Co., Ishpeming, Mich.
Arthur Crowfoot, Mill Supt., Phelps Dodge Corpn., Morenci, Ariz.
William B. Daly, Genl. Mgr. of Mines, Anaconda Copper Mining Co., 504 Hennessy Bldg., Butte, Mont.
Lucien Eaton, Supt., Ishpeming District, Cleveland-Cliffs Iron Co., Ishpeming, Mich.
Wm. H. Gallagher, Jr., Chf. Mng. Engr., Pickands-Mather & Co., 700 Sellwood Bldg., Duluth, Minn.
H. C. Goodrich, Chf. Engr., Utah Copper Co., Kearns Bldg., Salt Lake City, Utah.
T. O. McGrath, Asst. Mgr., Shattuck-Arizona Copper Co., Bisbee, Ariz.
Dr. Frank H. Probert, Dean, College of Mining, University of California, Berkeley, Calif.
Philip D. Wilson, Chief Geologist, Calumet & Arizona Mining Co., Warren, Ariz.

Mine Drainage

Wm. H. Gallagher, Jr., *Chairman*

H. T. Abrams, Dept. Mgr. of Air Lift Pumps and "Calyx" Drills, Ingersoll-Rand Co., 11 Broadway, New York City.
G. L. Kollberg, Mgr., Pumping Engine Dept., Allis-Chalmers Mfg. Co., Milwaukee, Wis.
O. D. McClure, Chief Mech. Engr., Cleveland-Cliffs Iron Co., Ishpeming, Mich.
Charles Mendelsohn, Master Mechanic, Old Dominion Company, Globe, Ariz.
W. A. Rankin, Elec. Engr., Copper Range Company, Painesdale, Mich.
W. N. Tanner, Chief Engr., Anaconda Copper Mining Co., 514 Hennessy Bldg., Butte, Mont.
C. D. Woodward, Chief Elec. Engr., Anaconda Copper Mining Co., 514 Hennessy Bldg., Butte, Mont.

Drilling Machines and Drill Steel

Frank Ayer, *Chairman*

SUB-COMMITTEE NO. 1—DRILLING MACHINES

B. F. Tillson (*Chairman*), Asst. Supt., New Jersey Zinc Co., Franklin, N. J.
L. C. Bayles, Designing Engr., Rock Drill Dept., Ingersoll-Rand Co., Phillipsburg, N. J.
Arthur B. Foote, Genl. Mgr., North Star Mines Co., Grass Valley, California.
J. A. Fulton, Idaho-Maryland Mines Co., Grass Valley, California.
Roy H. Marks, Efficiency Engr., United Verde Extension Mng. Co., Jerome, Arizona.
R. T. Murrill, Efficiency Engr., St. Joseph Lead Co., Rivermines, Mo.
R. A. Scott, Sales Mgr., Denver Rock Drill Mfg. Co., 39th and Williams St., Denver, Colo.
W. C. Scott, Supt., Morenci Branch, Phelps Dodge Corpn., Metcalf, Ariz.
George A. Shaw, Mine Supt., Talache Mines, Inc., Talache, Idaho.
H. T. Walsh, Vice Pres., Sullivan Machinery Co., Peoples Gas Bldg., Chicago, Ill.

SUB-COMMITTEE NO. 2—DRILL STEEL

Norman B. Braly, Genl. Mgr., North Butte Mng. Co., Butte, Mont.
E. G. Deane, Mgr., Superior & Boston Copper Co., Copper Hill, Ariz.
O. J. Egleston, Mgr., U. S. Smelting, Refining & Mining Co., Kennett, Calif.
C. S. Elayer, Clouderoft, New Mexico.
E. F. Hastings, Salesman, Ingersoll-Rand Co. of Texas, Dominion Hotel, Globe, Ariz.
Chas. S. Hurter, Tech. Representative, E. I. du Pont de Nemours & Co., Inc., 5104 Du Pont Bldg., Wilmington, Del.
Charles B. Officer, Asst. to Pres., Sullivan Machinery Co., 122 So. Mich. Ave., Chicago, Ill.
Henry S. Potter, Managing Director, Henry S. Potter, Ltd., 26 Cullinan Bldg., Johannesburg, South Africa.
Ocha Potter, Supt., Ahmeek-Kearsarge Br., Calumet & Hecla Mng. Co., Ahmeek, Mich.
Chas. A. Smith, Asst. Genl. Mgr., Ray Consolidated Copper Co., Ray, Ariz.
A. S. Uhler, Mgr., Rock Drill Sales, Ingersoll-Rand Co., 11 Broadway, New York City.
M. van Siclen, Engr., In Charge of Mining Research, U. S. Bureau of Mines, Washington, D. C.
Bruce C. Yates, Supt., Homestake Mining Co., Lead, South Dakota.

SUB-COMMITTEE NO. 3—METHODS OF SHARPENING DRILL STEEL

George H. Gilman, Pres., Gilman Mfg. Co., E. Boston, Mass.
Chas. E. Lees, Supt., Iron Cap Copper Co., Copper Hill, Ariz.
Frank W. McLean, United Verde Copper Co., Jerome, Ariz.
Arthur Notman, Cons. Engr., 170 Broadway, New York City.
W. H. Schacht, Genl. Mgr., Copper Range Co., Painesdale, Mich.
H. W. Seamon, Supt., Comstock Merger Mines, Inc., Virginia City, Nevada.
W. R. Wade, 34 Lafayette Park, Lynn, Mass.

Underground Transportation

William B. Daly, *Chairman*

Thos. C. Baker, Genl. Mgr., The Comstock Merger Mines Co., Virginia City, Nevada.
George H. Booth, Mech. Engr., Inspiration Cons. Co., Inspiration, Arizona.
R. R. Boyd, Asst. Supt., Mine Dept., Copper Queen Branch, Phelps Dodge Corpn., Bisbee, Arizona.
D. S. Calland, Managing Director, Compania de Real del Monte de Pachuca, Pachuca, Hidalgo, Mexico.
W. R. Crane, Supt., Southern Station, U. S. Bureau of Mines, New Federal Bldg., Birmingham, Alabama.
W. Val DeCamp, Genl. Mine Supt., United Verde Copper Co., Jerome, Arizona.
Robert H. Dickson, Supt., 85 Branch, Calumet & Arizona Mining Co., Valedon, New Mexico.
Stanly A. Easten, Mgr., Bunker Hill & Sullivan Mng. & Concentrating Co., Kellogg, Idaho.
H. T. Hamilton, Cons. Mng. Engr., 1408 California Commercial Union Bldg., San Francisco, California.
F. H. Hayes, Mine Supt., Copper Queen Branch, Phelps Dodge Corpn., Bisbee, Arizona.
R. E. Howe, Genl. Supt., Cananea Cons. Copper Co., Cananea, Sonora, Mexico.
John Kiddie, Mine Supt., Phelps Dodge Corpn., Morenci, Arizona.
C. A. Lantz, Genl. Mgr., Compania de Santa Gertrudis, S. A., Apartado No. 1, Pachuca, Hidalgo, Mexico.
E. M. Norris, Asst. Genl. Supt. of Mines, Anaconda Copper Mining Co., Butte, Mont.
Thomas K. Scott, Supt., Munro Iron Mining Co., Iron River, Mich.
Andover Syverson, Prescott, Arizona.

Fire-Fighting Equipment

Wm. Conibear, *Chairman*

SUB-COMMITTEE NO. 1—CONTROL OF VENTILATING EQUIPMENT DURING MINE FIRES

Orr Woodburn (*Chairman*), Safety Engr., Globe-Miami District, Globe, Ariz.
Guy J. Johnson, Mgr., Golden Gate Mine and Timber Co., Atlantic City, Wyo.
H. J. Rahilly, Supt., Mine Fire and Hydraulic Filling Dept., Anaconda Copper Mining Co., Butte, Mont.
Albert Fallon, Safety Inspector, The Old Dominion Co., Globe, Ariz.
J. T. Young, Safety Inspector, Arizona Copper Company, Morenci, Ariz.

SUB-COMMITTEE NO. 2—FIRE HOSE

R. H. Seip (*Chairman*), New Jersey Zinc Co., Franklin, N. J.
C. W. Moon, Safety Inspector, Phelps Dodge Corpn., Bisbee, Ariz.
B. O. Pickard, District Engineer, U. S. Bureau of Mines, Berkeley, Calif.

Mining Excavating Equipment—Exclusive of Dredges

H. C. Goodrich, *Chairman*

H. G. S. Anderson, Mng. and Met. Engr., Rolla, Mo.
H. C. Bellinger, Vice Pres., Chile Exploration Co., 25 Broadway, New York City.
Michael Curley, Genl. Supt., New Cornelia Copper Co., Ajo, Ariz.
H. T. Gracely, Adv. Mgr., Marion Steam Shovel Co., Marion, Ohio.
C. B. Lakenan, Genl. Mgr., Nevada Cons. Copper Co., McGill, Nev.
W. J. Lester, Pres., Kentucky Washed Coal Co., Greenville, Ky.
Geo. Mieyr, Supt., Sacramento Hill, Copper Queen Branch, Phelps Dodge Corpn., Bisbee, Ariz.
G. A. Murfey, Treas. and Chief Engr., The Browning Co., 16226 Waterloo Rd., Cleveland, Ohio.
Henry B. Oatley, Vice Pres., Superheater Co., 17 E. 42nd St., New York City.
Thos. A. Snyder, Bucyrus Co., South Milwaukee, Wis.
Robt. E. Tally, Genl. Mgr., United Verde Copper Co., Jerome, Ariz.
J. C. Wheat, Development Engr., Industrial Works, Bay City, Mich.
Charles S. Whitaker, Vice Pres., Winston Bros. Co., 801 Globe Bldg., Minneapolis, Minn.

Mine Ventilation

Chas. A. Mitke, *Chairman* (*Temporary*)

Robt. N. Bell, Cons. Mng. Engr., Box 1339, Boise, Idaho.
Walter C. Browning, Genl. Mgr., Magma Copper Co., Superior, Ariz.
O. K. Dyer, Mgr., Small Blower Dept., Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Daniel Harrington, 507 Newhouse Bldg., Salt Lake City, Utah.
E. T. Lednum, Mgr., E. I. du Pont de Nemours & Co., Inc., 406 Ideal Bldg., Denver, Colo.
C. E. Legrand, Cons. Engr., Phelps Dodge Corpn., Douglas, Ariz.
F. W. Maclennan, Genl. Mgr., Miami Copper Co., Miami, Ariz.
Don M. Rait, Asst. Supt. of Mines, Calumet and Arizona Mining Co., Warren, Ariz.
A. S. Richardson, Ventilation Engr., Anaconda Copper Mining Co., Butte, Mont.
Wm. A. Rowe, Chief Engr., American Blower Co., 6004 Russell St., Detroit, Mich.
A. C. Stoddard, Chief Mine Engr., Inspiration Cons. Copper Co., Inspiration, Ariz.
F. L. Stone, Industrial Engineering Dept., General Electric Co., Schenectady, N. Y.
E. B. Williams, Mgr., Marine Dept., B. F. Sturtevant Co., Hyde Park, Boston, Mass.

Mechanical Loading Underground

Lucien Eaton, *Chairman*

SUB-COMMITTEE NO. 1—LOADING MACHINES FOR TUNNELS, LARGE DRIFTS AND STOPES

Douglas C. Corner (*Chairman*), Mng. Engr., 1004 Federal Reserve Bank Bldg., St. Louis, Mo.
H. E. Billington, Vice Pres. for Sales, The Thew Shovel Co., Lorain, Ohio.
J. H. Henaley, Mine Supt., Miami Copper Co., Miami, Ariz.
H. DeWitt Smith, New York Trust Co., 100 Broadway, New York City.

OFFICERS AND COMMITTEES, 1925—(Concluded)

H. G. Washburn, Mng. Engr., American Smelting & Refining Co., McCormick Bldg., Salt Lake City, Utah.
Mr. William Whaley, Genl. Mgr., Myers-Whaley Co., Knoxville, Tenn.

SUB-COMMITTEE NO. 2—LOADING MACHINES FOR SMALL DRIFTS AND FOR WORK ON SUB-LEVELS

G. R. Jackson (*Chairman*), Supt., Cleveland-Cliffs Iron Co., Negaunee, Mich.
C. L. Berrien, Genl. Supt. of Mines, Anaconda Copper Mining Co., Butte, Mont.
H. H. Talboys, Mgr., Shuveloder Dept., Nordberg Mfg. Co., Milwaukee, Wis.
Chas. E. Van Barneveld, U. S. Bureau of Mines, Mississippi Valley Experiment Station, St. Louis, Mo.

SUB-COMMITTEE NO. 3—SCRAPERS

Lucien Eaton (*Chairman*), Supt., Ishpeming District, Cleveland-Cliffs Iron Co., Ishpeming, Mich.
C. L. Kohlhass, Denver Rock Drill Co., Duluth, Minn.
Ward Royce, Ingersoll-Rand Co., Houghton, Mich.
E. E. Whiteley, Supt. of Mines, Calumet & Arizona Mining Co., Warren, Ariz.

Mine Timbering

Frank H. Probert, *Chairman*

SUB-COMMITTEE NO. 1—PRESERVATION OF MINE TIMBERS

Geo. M. Hunt (*Chairman*), In Charge of Section of Wood Preservation, Forest Products Laboratory, Madison, Wis.
Gerald Sherman, Cons. Mng. Engr., Phelps Dodge Corpn., Douglas, Ariz.

SUB-COMMITTEE NO. 2—GUNITE AS A SUBSTITUTE FOR TIMBER, ITS PROPER APPLICATIONS AND ITS LIMITATIONS

E. M. Norris (*Chairman*), Asst. Genl. Supt. of Mines, Anaconda Copper Mining Co., Butte, Mont.
B. C. Collier, Pres., Cement-Gun Co., Inc., Allentown, Pa.
R. R. Horner, Cons. Engr., U. S. Bureau of Mines, Clarksburg, W. Va.

SUB-COMMITTEE NO. 3—DETERMINATION OF SIZE AND SHAPE OF DRIFTS AND DRIFT TIMBERS FOR VARIOUS PURPOSES, WITH A VIEW TO REDUCING SAME TO CERTAIN STANDARD SIZES AND SHAPES

Dr. F. W. Sperr (*Chairman*), Professor of Civil and Mining Engineering, Michigan College of Mines, 315 Florence St., Houghton, Mich.
C. L. Berrien, Genl. Supt. of Mines, Anaconda Copper Mining Co., Butte, Mont.
Felix McDonald, Mines Supt., Inspiration Cons. Copper Co., Inspiration, Ariz.

SUB-COMMITTEE NO. 4—COOPERATION BETWEEN OPERATORS AND LUMBER DEALERS AND MANUFACTURES, WITH A VIEW TO ASCERTAINING WHETHER FURTHER STANDARDIZATION IN SIZES AND SHAPES OF LUMBER UNDERGROUND WOULD RESULT IN A REDUCTION IN COST TO MINING COMPANIES

Charles F. Willis (*Chairman*), Editor and Publisher, Arizona Mining Journal, Phoenix, Ariz.
W. S. Boyd, Genl. Mgr., Ray Cons. Copper Co., Ray, Ariz.
T. Evans, Genl. Mgr., Cananea Cons. Copper Co., Cananea, Sonora, Mexico.
D. F. Holtman, Construction Engr., National Lumber Manufacturers Association, 402 Transportation Bldg., Washington, D. C.
G. R. Jackson, Supt., Negaunee Mine, Cleveland-Cliffs Iron Co., Negaunee, Mich.
John Kiddie, Mine Supt., Phelps-Dodge Corpn., Morenci, Ariz.
W. G. McBride, Genl. Mgr., Old Dominion Co., Globe, Ariz.

Mine Accounting

T. O. McGrath, *Chairman*

L. S. Cates, Vice-Pres. and Genl. Mgr., Utah Copper Co., Salt Lake City, Utah.
J. C. Dick, Mng. Engr., 511 Newhouse Bldg., Salt Lake City, Utah.
L. K. Diffenderfer, Secy. and Treas., Vanadium Corporation of America, 120 Broadway, New York City.
H. B. Fernald, Loomis-Suffern & Fernald, 50 Broad St., New York City.
H. H. Miller, General Auditor, Hercules Mining Company, Wallace, Idaho.
H. L. Norton, Phelps-Dodge Corpn., Douglas, Ariz.
Harry Vivian, Chief Engr., Calumet & Hecla Cons. Copper Co., Calumet, Mich.
Geo. Young, Secy. and Treas., Cananea Cons. Copper Co., Cananea, Sonora, Mexico.

Milling and Smelting Practices and Equipment

Arthur Crowfoot, *Chairman*

SUB-COMMITTEE NO. 1—MILLING PRACTICES AND EQUIPMENT

Arthur Crowfoot (Chairman), Mill Supt., Phelps-Dodge Corpn., Morenci, Ariz.
H. G. S. Anderson, Rolla, Mo.
Herman C. Bellinger, Vice-Pres., Chile Exploration Co., 25 Broadway, New York City.
Allan J. Clark, Supt. of Mills, Homestake Mining Co., Lead, S. Dak.
G. R. Delamater, Fuel Engr., W. S. Tyler Co., Superior St., Cleveland, Ohio.
W. M. Drury, Genl. Mgr., Mining Dept., American Smelting and Refining Co., El Paso, Tex.
Guy H. Ruggles, Mill Supt., Inspiration Cons. Copper Co., Inspiration, Ariz.
Henry A. Tobelmann, Cons. Engr. and Chemist, Associated Industries, 21 E. 40th St., New York City.
William Young Westervelt, Cons. Mng. Engr., 522 Fifth Ave., New York City.

SUB-COMMITTEE NO. 2—SMELTING PRACTICES AND EQUIPMENT

J. Owen Ambler, Smelter Supt., Phelps-Dodge Corpn., Clifton, Ariz.
P. P. Butler, Supt. of Douglas Reduction Works, Phelps-Dodge Corpn., Douglas, Ariz.
Harry A. Clark, Smelter Supt., Calumet and Arizona Mining Co., Douglas, Ariz.
Kuno Doerr, Genl. Mgr., Southwestern Dept., American Smelting & Refining Co., El Paso, Tex.
F. L. Flynn, Toltec Club, El Paso, Tex.
Professor Carle R. Hayward, Associate Professor of Metallurgy, Mass. Institute of Technology, Cambridge, Mass.
George W. Prince, Asst. Genl. Mgr., United Verde Extension Mining Co., Clemenceau, Ariz.
Forest Rutherford, Cons. Metallurgical Engr., 50 Broad St., New York City.

Methods of Mine Sampling, Methods of Recording Underground Geological Data, and Methods of Estimation of Ore Reserves For Low Medium and High Grade Ore bodies

Philip D. Wilson, *Chairman*

Guy Bjorge, Cons. Mng. Geologist, 788 Mills Bldg., San Francisco, Calif.
E. L. Derby, Jr., Chief Geologist, Cleveland-Cliffs Iron Co., Ishpeming, Mich.
M. J. Elsing, Mng. Engr. and Geologist, Warren, Ariz.
Dr. L. C. Graton, Professor of Geology, Harvard University, Cambridge, Mass.
Julius Kruttschnitt, Jr., Mgr., Mining Dept. of the Southwest, American Smelting and Refining Co., Tucson, Ariz.
F. A. Linforth, Asst. Chf. Geologist and Asst. Chf. Mng. Engr., Anaconda Copper Mining Co., 526 Hennessy Bldg., Butte, Mont.
Albert Mendelsohn, Underground Supt., Champion Copper Co., Painesdale, Mich.
MacHenry Mosier, Asst. Mine Supt., Morenci Branch, Phelps-Dodge Corpn., Morenci, Ariz.
Louis E. Reber, Jr., Chf. Geologist, United Verde Copper Co., Jerome, Ariz.
T. Skewes Saunders, Cons. Mng. Engr., La Mutua 525, Av. Cinco De Mayo No. 2, Mexico, D. F.
J. B. Tenney, Geologist, Copper Queen Branch, Phelps-Dodge Corpn., Bisbee, Ariz.
Robert W. Thomas, Supt. of Mines, Ray Cons. Copper Co., Ray, Ariz.

Joint Publicity Committee

Representing Coal Mining Branch:

Ralph C. Becker, Vice-Pres., Keystone Consolidated Publishing Company, 800 Penn Ave., Pittsburgh, Pa.
C. H. Trik, Sales and Mine Ventilation Engr., Jeffrey Mfg. Co., Columbus, Ohio.

Representing Metal Mining Branch:

T. O. McGrath, Asst. Mgr., Shattuck-Arizona Copper Co., Bisbee, Ariz.
Charles F. Willis, Editor and Publisher, Arizona Mining Journal, Phoenix, Ariz.

COMMITTEES

COOPERATION

AMERICAN MINING CONGRESS AND AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS

A. M. C.

A. Cressy Morrison, 30 E. 42nd St., New York City.
J. E. Spurr, Hill Bldg., New York City.
W. R. Ingalls, 115 Broadway, New York City.
J. R. Finlay, 170 Broadway, New York City.
Daniel B. Wentz, Land Title Bldg., Philadelphia, Pa.

A. I. M. & M. E.

E. P. Mathewson, 42 Broadway, New York City.
W. L. Saunders, 11 Broadway, New York City.
Walter Douglas, 99 John St., New York City.
Benjamin B. Thayer, 25 Broadway, New York City.
Samuel Taylor, Second National Bank Bldg., Pittsburgh, Pa.

ALASKAN AFFAIRS

John A. Davis, U. S. Bureau of Mines, Berkeley, Calif.
Falcon Joslin, 2203 L. C. Smith Bldg., Seattle, Wash.
Bart L. Thane, 408 Crocker Bldg., San Francisco, Calif.

MINING IN FOREIGN COUNTRIES

J. E. Spurr, *Chairman*, Hill Bldg., New York City.
Van H. Manning, 15 West 44th St., New York City.
E. L. Doheny, 120 Broadway, New York City.
W. J. Loring, Merchants National Bank Bldg., Los Angeles, Calif.
Matthew C. Fleming, New York City.
H. Foster Bain, 29 W. 39th St., New York City.

ADVISORY COMMITTEE UNITED STATES BUREAU OF MINES AND GEOLOGICAL SURVEY

Bulkeley Wells, *Chairman*, San Francisco, Calif.
Walter Douglas, New York City.
Rembrandt Peale, New York City.
H. Foster Bain, 29 W. 39th St., New York City.
George Otis Smith, U. S. Geological Survey, Washington, D. C.

DEPARTMENT OF MINES AND MINING

W. J. Loring, *Chairman*, San Francisco, Calif.
Walter Douglas, New York City.
Bulkeley Wells, San Francisco, Calif.
George H. Crosby, Duluth, Minn.
D. C. Jackling, Hobart Bldg., San Francisco, Calif.
Carl Scholz, Charleston, W. Va.
S. D. Warriner, Philadelphia, Pa.

COOPERATION INTERNAL REVENUE DEPARTMENT

J. F. Callbreath, American Mining Congress, Munsey Bldg., Washington, D. C.
John T. Barnett, 1024 Lafayette St., Denver, Colo.
Paul Armitage, 2174, 233 Broadway, New York City.
L. C. Boyle, Kansas City, Mo.
Rush C. Butler, Chicago, Ill.

UNIFORM COAL MINE REPORTS

S. A. Taylor, Second National Bank Bldg., Pittsburgh, Pa.
Carl Scholz, Professional Building, Charleston, W. Va.
A. H. Land, Huntington, W. Va.
Morton L. Gould, 701 Terminal Bldg., Indianapolis, Ind.
G. H. Caperton, Box 601, Charleston, W. Va.
Thomas T. Brewster, St. Louis, Mo.

OPERATORS' CO-OPERATING COMMITTEE

PETROLEUM

J. G. BRADLEY, *Chairman*
J. F. CALLBREATH, *Secretary*

E. L. Doheny, Mexican Petroleum Co., 120 Broadway, New York City.
George S. Davidson, Gulf Refining Co., Pittsburgh, Pa.
A. L. Beaty, Texas Co., 17 Battery Pl., New York City.
H. F. Sinclair, Sinclair Oil Co., 45 Nassau St., New York City.
Walter Teagle, Standard Oil Co. of N. J., New York City.

METALS

Bulkeley Wells, Hobart Bldg., San Francisco, Calif., Gold.
F. B. Richards, Leader-News Bldg., Cleveland, Ohio, Iron.
Edgar Z. Wallower, Joplin, Mo., Zinc.
B. B. Thayer, 25 Broadway, New York City, Copper.

COAL

J. G. Bradley, Elk River Coal & Lumber Co., Dundon, W. Va.
T. H. Watkins, Pennsylvania Coal & Coke Corp., New York City.
E. W. Parker, Anthracite Bureau of Information, Philadelphia, Pa.
Albert Nason, Nason Coal Co., Chicago, Ill.
J. G. Puterbaugh, McAlester Fuel Co., McAlester, Okla.
S. D. Warriner, Lehigh Coal & Navigation Co., Philadelphia, Pa.

COAL EXPORTS

Geo. S. Rice, Bureau of Mines, Washington, D. C.
John Callahan, Woodward Bldg., Washington, D. C.
Chas. A. Owen, Pres., Imperial Coal Corporation, 17 Battery Pl., New York City.
G. A. O'Reilly, Irving National Bank, New York City.

(*From the Craftsman's Dictionary*)

Background

Background—the idea, character and workmanship upon which a product is based; the intangible element upon which the user depends where he must purchase blindly.

Those manufacturers who have worked for years to establish their reputation for high standards of output and dealing go to great lengths to protect and further those reputations. They not only stand behind the products they turn out and make careful study of individual installations, but many of them maintain research laboratories that further the advance of science and industry generally.

The background for output that is known to be composed of high intelligence, integrity and skill of craft, not only increases sales for the company, but increases confidence and helps to stabilize the whole industry affected.

Men with such backgrounds make up the many committees that are carrying forward the work of standardizing mining methods and equipment. It is very encouraging to all who are interested in the future of mining to read the list on the foregoing pages of these men and the companies with which they are affiliated, who make up this great research laboratory that is conducted by the whole industry under the sponsorship of the American Mining Congress.

We will be glad to get in touch with you about any phase of this movement that interests you.

INDEX TO ADVERTISERS

	Page
Allis-Chalmers Manufacturing Co	15
Ameling Prospecting Co., Inc., H. R	27
American Steel & Wire Co	14
Aurora Pump & Manufacturing Co	25
The Austin Co	Inside Back Cover
Boyle, Jr., John	29
Cameron Steam Pump Works, A. S. (Ingersoll-Rand Co.)	11
Central Frog & Switch Co	27
Central Steel Co	13
Connellsville Manufacturing & Mine Supply Co	25
Diamond Machine Co	25
Du Pont de Nemours & Co., E. I	18
Fawcus Machine Co	25
General Coal Co	19
General Electric Co	8, 9
Goodman Manufacturing Co	7
Greene, Tweed & Co	15
Hercules Powder Co	3
Hoffman Brothers	27
Hyatt Roller Bearing Co	Inside Front Cover
Ingersoll Rand Co. (A. S. Cameron Steam Pump Works)	11
Irvington Smelting & Refining Works	27
Johnson Manufacturing Co., G. M	29
Keystone Churn Drill Co	23
Keystone Lubricating Co	29
Lehigh Coal & Navigation Co	19
Linde Air Products Co	21
Link Belt Co	34
Ludlow-Saylor Wire Co	4
Morse Chain Co	Back Cover
New York Engineering Co	27
Nuttall Co., R. D	23
Ohio Brass Co	23
Patrick, R. S	23
Phelps-Dodge Corporation	27
Roebling's Sons Co., John A	29
Stonehouse Signs, Inc	27
Thorne, Neale & Co., Inc	29
Timken Roller Bearing Co	25
Weller Manufacturing Co	14
West Virginia Rail Co	27
Wilmot Engineering Co	27

LINK-BELT
Engineers

first investigate then plan and build. This order of procedure is essential to success in underground mechanical equipment such as

FACE CONVEYORS

Before installing equipment of this nature, every mine executive should read what Link-Belt Engineers have to say on this subject. Send for copy of Folder 786

2354

LINK-BELT COMPANY

Leading manufacturers of Elevating, Conveying and Power Transmission Machinery

PHILADELPHIA, 2045 Hunting Park Ave.
Pittsburgh - - - - - - - 335 Fifth Ave.
St. Louis - - - - - - 3638 Olive St.

CHICAGO, 300 W. Pershing Road
Wilkes-Barre - 826 2nd National Bank Bldg.
Huntington, W. Va. - Robson-Prichard Bldg.

INDIANAPOLIS, 200 S. Belmont Ave.
Denver - - - - - - 520 Boston Bldg.
Birmingham, Ala. - 720 Brown-Marx Bldg.

LINK-BELT

INDEX

BUILDINGS DESIGNED AND CONSTRUCTED BY AUSTIN FOR THE TENNESSEE COPPER COMPANY, AT DUCKTOWN, TENN.

Austin Buildings for the Mining Industry

INTERIOR OF BUILDING SHOWN ABOVE

THE AUSTIN COMPANY

Engineers and Builders

CLEVELAND

New York Chicago Cleveland Detroit Pittsburgh
Philadelphia St. Louis Portland Birmingham Miami Seattle
The Austin Company of California: Los Angeles, San Francisco
The Austin Company of Texas: Dallas

AUSTIN INDUSTRIAL CONSTRUCTION includes types suited to every building requirement of mine, smelter, concentrating plant, etc.

Austin has just recently designed and built an ingot building and warehouse for the Union Smelting & Refining Co., at Newark, N. J., on a 60-working-day contract, with a bonus and penalty clause.

No matter how big or complex the project Austin Engineers will work from your plans, or will design, construct and equip your project under the Austin Unit Responsibility Plan with one contract which gives you:

1—A guaranteed lump-sum price covering the complete job;

2—A guarantee that the complete plant will be ready by a specified date, with bonus and penalty clause, if preferred;

3—A guarantee as to quality of material and workmanship throughout.

Wire, phone or mail the coupon.

AUSTIN

Finance Engineering Construction Equipment

THE AUSTIN COMPANY, CLEVELAND

You may send me the new 100-page "Austin Book of Buildings."

We are interested in the construction of.....

.....data.....

.....

Firm.....

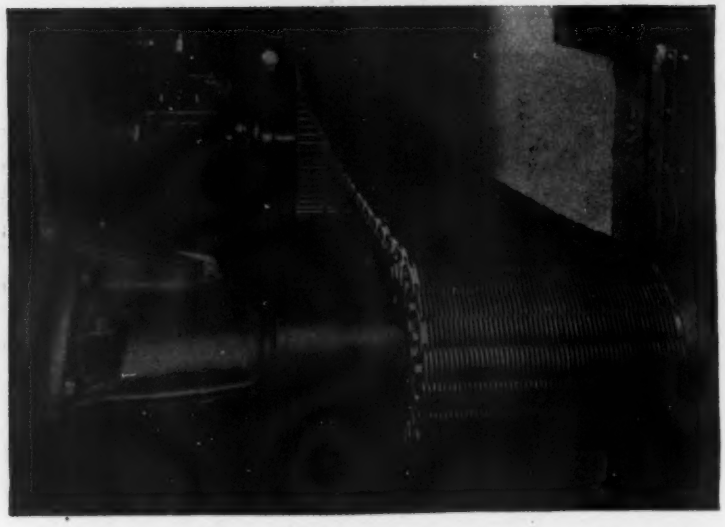
Individual.....

Address.....

M. C. J. 10-25.

MORSE SILENT CHAIN DRIVES

THE MORSE "ROCKER JOINT"



300-H.P. MORSE SILENT CHAIN DRIVE FROM MOTOR TO MINE FAN.
DRIVER, 435 R. P. M.; DRIVEN, 120 R. P. M.; 144-INCH CENTERS.

FOR LOWER COST PER TON

Ample power, properly applied, keeps down production costs in mine and mill. Cost of power at point of application is what counts, not merely cost of power at the switchboard. Efficient, dependable power transmission is a vital factor, a good reason for choosing Morse Silent Chain Drives. Used wherever ore is mined or refined.

THE ORIGINAL ROCKER JOINT CHAIN
offers

- Sustained Efficiency—98.6 percent.
- Positive speed ratio between shafts
- High rates of speed reduction in single drive
- Quietness at all speeds
- Convenience of application
- Reliability, long life, low upkeep

Morse Chain installations from 1/4 to 5,000 H.P. aggregate more than 4,000,000 H.P. Speeds from 6,000 to 250 R.P.M. or slower. Especially effective on short centers.

Consult Morse Engineer at Nearest Office

MORSE CHAIN CO., ITHACA, N. Y., U. S. A.

There is a Morse Engineer near you

ATLANTA, GA., 702 Candler Bldg., Earl F. Scott & Co.
BALTIMORE, MD.....1402 Lexington Bldg.
BIRMINGHAM, ALA...Moore-Handley Hdw. Co.
BOSTON, MASS.....141 Milk St.
CHARLOTTE, N. C...404 Commercial Bk. Bldg.
CHICAGO, ILL.....112 W. Adams St.
CLEVELAND, OHIO.....421 Engineers Bldg.
DENVER, COLO.....211 Ideal Bldg.
DETROIT, MICH.....7601 Central Ave.
LOUISVILLE, KY., 516 W. Main St., E. D. Morton Co.
MINNEAPOLIS, MINN., 413 Third St., Strong-Scott Mfg. Co.
NEW ORLEANS, LA., 521 Baronne St. A. M. Lockett Co.
NEW YORK CITY, N. Y.....50 Church St.
OMAHA, NEB., 727 W. O. W. Bldg., D. H. Braymer Equipt. Co.
PHILADELPHIA, PA...803 Peoples Bk. Bldg.
PITTSBURGH, PA.....Westinghouse Bldg.
SAN FRANCISCO, CALIF...Monadnock Bldg.
ST. LOUIS, MO.....2137 Ry. Exchange Bldg.
TORONTO, 2, ONT., CAN...50 Front St., E., Strong-Scott Mfg. Co.
WINNIPEG, MAN., CAN.....Dufferin St., Strong-Scott Mfg. Co.

660